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"SENSIBLE TEMPERATURES."

BY

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On hot summer days people in our large cities constantly complain that the temperatures recorded at the local Weather Bureau stations are much too low, and hence do not really represent the heat which people feel. In cold winter weather there is a similar objection, to the effect that the "official" temperatures are too high. This complaint arises from the fact that the public generally does not yet understand that "air temperature," as recorded by a standard thermometer, at some distance above the ground, in a shelter, protected from rain and sunshine and radiation from surrounding objects, does not and cannot indicate the temperature that we actually feel. The latter, which has been called "sensible temperature," and which, for want of a better term, we shall also thus designate, depends upon a great variety of factors which either do not enter into the so-called "air temperature" at all, or else are of secondary importance. For example, other meteorological conditions, such as the humidity of the air, the wind, the exposure to direct insolation and to reflected heat, and other more or less accidental physical conditions, such as the state of the human body, whether in good health or bad; the clothing, both as to kind and as to amount; the kind and the conditions of occupation; the nourishment of the body; even the mental condition of the individual—these and other factors enter into the account.

The human body is not like a thermometer in having no temperature of its own. It is a heat engine, which has a high internal temperature to keep up. This temperature is maintained by a slow internal combustion, in which the food plays the part of the fuel

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in the steam engine, and heat is constantly being lost from the skin, as well as from the lungs, in the process of respiration, and in warming the food taken into the stomach. Helmholtz believed that over three-quarters of the total loss takes place from the skin, and about 20% from the lungs. The loss from the lungs varies with the temperature and with the relative humidity of the air; the higher the temperature and the relative humidity, the less is the loss. The loss of water from the lungs is not directly noticeable. We estimate the moisture of the atmosphere chiefly by the loss of water from the skin, which amounts to about twice as much as that from the lungs.

The loss of heat from the external surface of the body, as has been clearly set forth by Van Bebber (of whose discussion the next few paragraphs are largely a summary), is accomplished by means of three familiar physical processes—conduction, radiation, evaporation. The amount of heat lost by conduction depends on the difference of temperature between the body and the surrounding air, and upon the conductivity of the air. Other things being equal, the colder the air the greater the cooling by conduction; the warmer the air, the less. Hence, conduction may be expected to be at a maximum in winter. Secondly, when there is wind, more heat is lost by conduction. Everyone knows that severe cold which may be easily endured when the air is calm may become unbearable when there is even a slight movement of the air. The springing up of a breeze on a bright, cold winter day may change the temperature which we feel from an agreeable one to one which is decidedly chilly, although the ordinary thermometer shows no change at all. The difference between calm cold and windy cold is very strikingly brought out in the reports from Arctic and Antarctic exploring expeditions. Temperatures of 20°, 30°, even 40°, below zero are described as being comfortable when there is no wind. Nansen, for example, says on one occasion, "The temperature to-day is 42° Fahr. below zero, but there is no wind, and we have not had such pleasant weather for walking for a long time; it feels almost mild when the air is still." Similar statements may be found in abundance in the writings of other Arctic explorers, it being frequently noted that the heavy clothing was too warm at these very low temperatures. In the Polar regions, then, the feeling of cold and the reading of the thermometer are not in any closer agreement than they are here. Naturally, high temperatures are more comfortable with some wind. Thirdly, the moisture of the air is an important consideration in this matter, for damp air

is a better conductor than dry air. Hence, in winter, damp cold is so much harder to bear than dry cold. Hence the damp northeast winds on the New England coast in winter often feel colder than dry northwest winds which have a lower temperature, although the velocity may be the same in the two cases. Obviously, however, evaporation enters in to complicate this question of conduction somewhat.

The amount of heat lost by the body through radiation depends on the temperature and the radiating powers of surrounding objects, such as walls, pavements, vegetation, furniture, etc. It is conceivable that one should be so placed that the temperature of all surrounding objects, and of the air as well, should be just the same as the body temperature. In such a case the body would lose nothing by radiation. Nor would it lose anything by conduction. The only loss would be by evaporation, unless the air were saturated, in which case the conditions would be unbearable for any length of time. When radiation is checked, as by the presence of many persons crowded together, or by the proximity of hot walls, pavements, etc., the body may suffer serious consequences, as in the case of prostration by the heat and sunstroke, which, as is well known, usually attack people who are exposed under rather special conditions, as, *e.g.*, labourers on sewers and railways, masons and painters close to the walls of buildings, etc. When troops are on the march it has been shown that the men who suffer most are in the middle of the column, where they can lose least heat by radiation.

It is difficult to consider the adjustment of the body to the temperature conditions of the air without taking account of evaporation, which is of very great importance, and is almost always in operation to a greater or less degree. The human body in health has not a dry surface, like the dry-bulb thermometer, but is more or less moist because of the exudation of perspiration through the pores of the skin. When this moisture evaporates, the skin cools through the loss of heat which is required in the process of evaporation. Cramer has shown that the amount of water lost through perspiration during a hot summer day, if a man is kept at hard work, may reach between 7% and 8% of the weight of his body. Other things being equal, there is more evaporation the warmer, the drier, and the less quiet the air. The hotter the air, the greater its capacity for water vapour; the drier the air, the more water can still be evaporated into it; the more wind, the greater the opportunity for evaporation into the fresh supply of air which

is constantly brought to the body. If the air be completely saturated at the body temperature, there can be no evaporation; but if the air be saturated below the body temperature, the body warms the air nearest it; in so doing the capacity of the air for water vapour is increased, and evaporation may then begin again. Even if the temperature of the air be 98.6°, unless the air be saturated, the body can cool by evaporation. It has been shown that, when the air is very dry, human beings can endure extraordinarily high temperature, as in the case of a man who stayed twenty minutes in dry air at 212°. Hot air in motion is much cooler than hot dry air at rest, and hot moist air is oppressive because there is little opportunity for evaporation. According to Blanford, the moist heat felt during a voyage across the Red Sea in August or September, with an air temperature of 90°, is much more oppressive than is the heat in the upper provinces of India during the blowing of the "hot winds," which are dry, when the temperature is 112° to 118°. The excessive dryness of these winds is made use of to keep the air of dwellings cooler by means of wet "tatties" hung over doors and windows. The more moist the air and the nearer its temperature to that of the body, the less difference does wind make. Dry air is in many respects an advantage at all seasons; in winter, because it makes the loss of heat by conduction less, and in summer, because it increases the loss of heat by evaporation.

Evidently, too, conduction enters into this question, for when the air is moist, evaporation is lessened, but conduction (unless the air be at the body temperature) is increased. On the whole, conduction is at a maximum in winter, and evaporation in summer. The very dry air of our furnace-heated houses in winter must be kept at a high temperature if we wish to be comfortable in it. We lessen the loss of heat from the body by conduction when we raise the temperature, but the loss by evaporation must be very great, because of the dryness of the air. If our houses were provided with a more moist heat we could be comfortable indoors with considerably lower temperature, because evaporation would be so much decreased. This has been experimentally determined by Dr. Henry J. Barnes, of Boston, who found that when the air in his office had a relative humidity of 27% the temperature had to be 70° or 71°, but when, by means of a "humidifier," which evaporated 4½ quarts of water daily, he had brought the air to a relative humidity of 53%, a temperature of 65° was comfortable. The temperatures in our houses are comfortable at about 70°, because

the air is calm. If the air were in motion we should be uncomfortably cool, because of the increased evaporation.

The temperature which we feel does not depend solely on the temperature, the moisture, and the movement of the air. It is also influenced by the physical condition in which the body finds itself, for the body is not a passive object. When in health it adjusts itself to surrounding conditions by its own action. At low temperatures it seeks to check the loss of heat from its surface by contracting the pores, keeping the skin dry, and diminishing the amount of heat near the surface of the body. At high temperature, on the other hand, the pores are opened, perspiration is abundant, and the skin is cooled by evaporation. Furthermore, the relations of the body to the meteorological conditions of the atmosphere are affected to a very marked degree by the clothing. Many interesting experimental studies have shown that the differences between the temperature on the surface of the clothing and the air temperature decrease with an increasing number of articles of clothing between the skin and the outside air. The successive air strata between the different layers of clothing serve to modify the effect of the temperature and humidity of the air. Thus clothing, whose thickness, weight and texture may be varied at will, keeps the body from losing heat too rapidly to the surrounding air. Rübner has found that the temperature on the skin of a man dressed in the usual number of articles of winter clothing was about the same when the air temperature was 50° and when it was 79°. In this connection, the behaviour of different kinds of clothing materials in relation to moisture is naturally of considerable importance. Evidently, also, the questions whether the individual is taking exercise, how violent the exercise, and under what conditions with reference to surrounding objects, are all to be considered as controlling factors, for, obviously, on a cold day, two persons will experience very different temperatures if one of them is sitting still and the other is digging a trench.

The factor of exposure to radiation, whether directly from the sun, or from the sky, the surface of the earth, or other objects, also enters into the problem. Unlike a thermometer, which is in a shelter, protected from direct and reflected radiation so far as possible, human beings when out of doors are exposed to these radiations, and their feeling of heat is affected thereby. It has long been known that the energy of direct insolation is of great importance as a climatic factor, independently of the temperature of the air. In times of calm the air temperature may even be quite

unimportant. Thus on calm, clear winter days, for example, if one sits in the sun, he may feel warm and comfortable while the air temperature is really very low. It is this climatic factor of direct solar radiation which is of great value in giving certain high mountain stations, in the Alps and elsewhere, their reputation as winter resorts. At Davos Platz, for example, and, similarly, in some of our own health resorts in Colorado, invalids may sit out in the sun and be comfortable on the coldest winter days. Reflected heat, as from water, or from a desert surface, or from a white wall, also affects one's feeling of heat or cold.

It is evident, then, that the sensation of temperature is the complex resultant of many variables, and that it must necessarily be an individual matter, for it depends upon so many physical, and even mental, conditions which differ in each individual case. The "sensible temperature," so called, is essentially a nervous sensation. This being so, it is also evident that no single instrument can possibly give an indication of the temperature which the body actually feels. There has, however, been a desire to find some simple expression for this "sensible temperature," and various suggestions have been made, both as to instrumental and as to non-instrumental expressions. The general public has shown a fondness for the use of "temperatures in the sun," *i. e.*, the readings of a dry-bulb thermometer exposed to sunshine, although these indications are well known to be practically worthless for any purposes of comparison, and to express no real climatic element. In 1826, Dr. W. Heberden, as Professor Abbe has pointed out, advanced the idea that sensible cold depends upon the rate at which the internal heat is carried away from the surface of the body, and proposed to use the rate of cooling of an ordinary thermometer as a measure of the sensible cold. About 1871, J. W. Osborne proposed to measure the sensible temperature by the time required for a mass of water, heated to the temperature of the human body, and contained in a paper cylinder, to cool. Osborne discovered that the temperature which affects human beings is very different from that indicated by the ordinary thermometer. In view of the great importance of the humidity of the air in controlling our sensation of heat or cold, it was later naturally suggested that the readings of the wet-bulb thermometer should be used to indicate the sensible temperature, this instrument, as is well known, reading lower than the dry-bulb thermometer under ordinary conditions because of the evaporation of water from its surface. Although the wet-bulb readings do not indicate what human beings feel, because the wet-

bulb thermometer is not an organic body, with internal heat, varying conditions of covering, of health, of work, of exposure, of radiation, and so on, yet these readings have been generally spoken of as if they really expressed the temperature which is felt by us. If the expression "sensible temperatures" is to be used for the temperatures which the human body feels, we ought not to call wet-bulb readings by that name.

In view of the importance of the temperatures recorded by means of the wet bulb, the Weather Bureau, in September, 1895, began to tabulate them on the daily weather maps, but this practice was discontinued after a time. Although these readings are not satisfactory, Hann recommends that they be included among the other temperature records in climatic tables, because they furnish "a convenient index of the heat which is actually felt by the human body." Professor Harrington has constructed a chart of the July wet-bulb temperatures for the whole of the United States, and another which shows the reduction of the temperature by evaporation in the same month. Professor Willis L. Moore, Chief of the Weather Bureau, has also published a chart showing the average actual and sensible temperatures of the United States for the summer season, deduced from eight years' observations at 8 A.M. and 8 P.M., Eastern standard time. In Death Valley, Cal., the observers of the Weather Bureau experienced five days in the summer of 1891 on which the maxima were 122°. The wet-bulb thermometer, however, indicated only 73° to 77°, so that the temperature actually felt by any one who was in a favourable location, *i. e.*, protected against heating by direct sunshine, was almost as low as that of an ordinary summer afternoon, in so far as evaporation alone was concerned. On August 4 and 5, the maxima in Death Valley were 117.9° and 113.9°, but the readings of the wet-bulb thermometer were only 69.8° and 66.9°.

Quite recently a novel form of instrument has been suggested, which is designed to approximate much more closely to the actual conditions than does the wet-bulb thermometer. This instrument, called the "Deperditometer," is to be a porous cell, covered with some organic membrane, and filled with distilled water. The water is to be kept at the temperature of the body by means of a gas jet, automatically regulated. The amount of heat needed to keep the cell at the proper temperature is to be a measure of the quantity of heat lost from the cell.

The most careful instrumental study of the temperature, as felt by the human body, was made a few years ago by Vincent, of

Brussels. Vincent slowly rubbed the palm of his left hand and his cheek with the small cylindrical bulb of a thermometer until the latter indicated a constant temperature, the skin being exposed to wind and to sunshine during the observations. On the basis of 365 observations, Vincent obtained the following formula:

$$H = 26.5 + 0.3\,L + 0.2\,S - 1.2\,W$$

Where H = temperature of the skin, L = air temperature, S = insolation (excess of black bulb over air temperature), and W = wind velocity in metres per second. Vincent's results, while really applicable to his individual case only, are noteworthy because they are the first of the kind obtained. The factors taken into account in the formula, it will be observed, are but three, and do not include atmospheric humidity.

The importance of finding some expression for the sensation of temperature led Professor Abbe to suggest that, in climatic tables, days should be classified according to the sensation which they produce in the observer, as, for example, such feelings as "harshness," "rawness," "mildness," "oppression," "cheerfulness," etc. In 1876, J. W. Osborne proposed a definite scale of "subjective temperatures" to be used in such observations, there being twenty different degrees in the scale, running from 20., *Intolerably hot*, to 1., *Unbearably cold*. Obviously, it would be impossible to have observations of this sort comparable, because each observer would differ so much in his own feelings of cold and heat, of exhilaration and depression. Professor Abbe has also suggested noting on a diagram, on which relative humidities and temperatures are indicated by the ordinates and abscissæ, the points where, on any day or days, the observer feels like saying, "The weather is perfect." In this way he has himself drawn a diagram which, for winds of varying velocities, shows for him a condition of temperature and relative humidity which is perfectly comfortable. This method makes it possible for each individual to draw his own personal diagram of what Professor Abbe calls "curves of comfort." Curves may, of course, also be drawn for conditions of discomfort, such as extreme rawness, suffocating heat, etc.

There have been several interesting suggestions in connection with the feeling of heat or cold as dependent upon temperature and relative humidity, without taking into account the remaining factors in the problem. Thus Lancaster, Chief of the Belgian Meteorological Service, has tried to determine what degrees of relative humidity give certain high temperatures an oppressive feeling of heat. The observations were made in calm weather, and relate to

one individual, in Belgium. Lancaster found, for his own feelings, that the heat became very oppressive when the relative humidity rose above the following percentages for the accompanying temperatures:

Fahr.....	84°	82.5°	80.5–77°	75–73.5°	71.5°–70°
Rel. Hum....	45%	50%	65%	70%	75%

Comparing these conditions with those of a typical moist tropical climate, Lancaster found that at Vivi, in the Congo Free State, the average relative humidity with a temperature of 86°F. is 59% during December–May; while in Belgium for the same temperature it is 36%. If the relative humidity in Belgium rises to 40% at a temperature of 86°, the heat becomes insupportable.

Another recognition of the importance of relative humidity as a factor in climate is Ravenstein's classification of climates on the basis of relative humidity and temperature. He suggests sixteen *hygrothermal* types for the earth as a whole, ranging from *hot* (temperature 73° and over) *and very damp* (humidity 81% or more) through *warm and moderately damp*, *cool and very damp*, etc., to *cold and very dry*. One extreme (*hot and very damp*) is represented by Batavia; the other (*cold and very dry*) by the Pamir.

The temperatures which we feel are really the complex resultant of many variables. The suggestion of a New York newspaper, that the Weather Bureau, in its forecasts of temperature, should take account of temperature, wind velocity, and humidity, so that a single statement "would express just what people mean when they say that the day is hot or cold," is absurd on the face of it. The sensible temperature is so complex and so individual that no such forecast can be made which would be of any general value whatever.

BIBLIOGRAPHY.

C. ABBE: "Scientific Record for 1883." Report on Meteorology, Annual Report of the Smithsonian Institution for 1883, 491. "Sensible Temperatures," Monthly Weather Review, 1895, 93–94. "Sensible Temperatures, or the Curve of Comfort," *ibid.*, 1898, 362–363. "Sensible Temperatures," *ibid.*, 1899, 18.

H. F. BLANFORD: "Climates and Weather of India, Ceylon, and Burmah," 1889, 48.

I. M. CLINE: "Influences of Climatic Conditions and Weather Changes on the Functions of the Skin." Read before Texas State Medical Association, April, 1896. Printed in Proceedings of same.

W. A. GLASSFORD: "Why Summer in the Apparently Hot Arid Region is Comfortable." Monthly Report, Oregon State Weather Service, Jan., 1896, 23–29.

J. HANN: "Handbook of Climatology." Vol. I. Translated by R. DeC. Ward. 1903, 43–46.

MARK W. HARRINGTON: "Notes on the Climate and Meteorology of Death Valley, California," Weather Bureau Bulletin No. 1, 1892. "Sensible Temperatures," International Medical Magazine, August, 1894.

A. LANCASTER: "De la Manière d'utiliser les Observations Hygrométriques." Rapport lu au Ve Congrès International d'Hydrologie, de Climatologie et de Géologie Médicales à Liège, 1898. Liège, 1899.

W. L. MOORE: "Some Climatic Features of the Arid Regions." U. S. Dept. of Agric. Weather Bureau. 8vo. Washington, 1896.

J. W. OSBORNE: "Determination of Subjective Temperatures." Proc. Amer. Assoc. Adv. Sci., XXV, 1876, 66–74.

E. G. RAVENSTEIN: "The Geographic Distribution of Relative Humidity." Brit. Assoc. Adv. Sci., 1900.

RÜBNER AND V. LEWASCHEW: Archiv. für Hygiene, 1897. (Met. Zeitschr., 1898, 148–149.)

W. J. VAN BEBBER: "Hygienische Meteorologie." Stuttgart, 1895.

J. VINCENT: "La Détermination de la Température Climatologique." Brussels, 1890. Reprinted from Ann. de l'Observ. roy. pour 1890.

SYMONS'S Met. Mag., 1899, 45–46.

CONCERNING SEXTANT OBSERVATIONS FOR DETERMINING GEOGRAPHICAL POSITIONS.

BY

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1. Besides incidental and variable errors, all sextant observations are subject to certain fixed and generally unknown errors, as follows:

(1) Errors of the instrument. These are comprised in:

(*a*) Index error; that is, the uncertainty of the index error as found or used.

(*b*) Shade glasses; this can be corrected in some instruments by reversing, but to do so is not always convenient. The colored eye-piece is free from this error because affecting alike the direct and the reflected image.

(*c*) Telescope; collimation error, or lack of parallelism with plane of instrument; this, like the index error, we must expect to exist in some degree.

(*d*) Eccentricity of instrument; this can be determined with considerable accuracy if the proper appliances are provided, but it is not conveniently found, and is commonly neglected.

(*e*) Expansion and contraction of instrument by heat or cold; this is not practically susceptible of determination.

(*f*) Graduation error; this would probably be combined with eccentricity.

(2) Artificial horizon—error of the roof; this can be eliminated by reversal, but to do so is often inconvenient, especially with stars.

(3) Personal error of observer; this, while susceptible of approximate determination, is not a practicable correction.

(4) Refraction; as the correction depends on mean conditions of the atmosphere, it is manifestly impossible that this error should be entirely corrected. The error due to this cause at low altitudes may be very large. In sea observations it often seriously affects the dip correction as well.

2. All the foregoing sources of error may conspire in their effect, or may partially neutralize one another; the resultant of all, however, will be a fixed but unknown quantity for which we can, therefore, make no correction. We must simply accept the fact, and then, by combining observations in which the resultant unknown error acts in opposite or contrary directions, get rid of it by elimination. The elimination of errors, by making them correct each other, is the foundation of all delicate observation work with all instruments wherever it can possibly be introduced. For instance, in accurate triangulation a determination would not be accepted unless the angle were measured with telescope direct and reversed to eliminate the collimation error, and a round of angles taken to eliminate the eccentricity by the use of different portions of the limb.

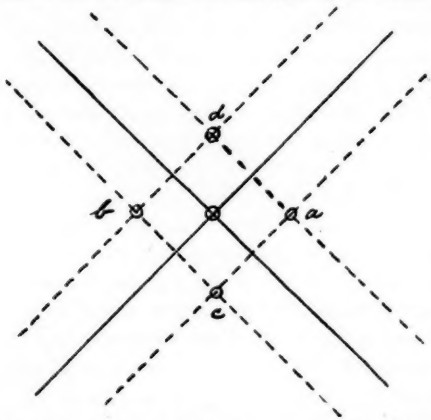
3. In determining geographical positions no work, however carefully done, can be properly accepted that does not depend on observations so combined as to effect the elimination of the fixed and unknown error. The effect of the error is exactly the opposite for observations on opposite sides of the zenith and opposite sides of the meridian.

4. For latitude we use, therefore, circum-meridian observations of stars in pairs, one north and the other south of the zenith, with zenith distances as nearly equal as possible; if the fixed error makes the latitude from the north star too large, that from the south star will be too small by the same amount; the error is eliminated in the mean result.

5. For longitude we must, likewise, use observations on opposite sides of the meridian. If the body observed east of the meridian makes our longitude too great, the western body makes it too small by the same amount, if symmetrically chosen, and in the mean result the error is eliminated. In equal altitudes the determination is made unconsciously, because we do not use or need correct altitudes, but only *equal* altitudes.

6. The effect of the fixed and unknown error and its elimination is interesting, as exemplified in the Sumner.

7. Suppose we obtain our position (both latitude and longitude) from two stars on the same side of the meridian, bearing respectively either NE. and SE. or NW. and SW., the resulting Sumner lines are indicated in the figure, in which the full lines are supposed to be obtained from correct altitudes. The effect of the unknown error will be shown by the parallel dotted lines on the right or left of the full lines, according as the unknown error operates to increase or decrease the observed altitude. If the former, the dotted lines on the right give by their intersection (a) the observed position from the eastern bodies; those on the left (b) the observed position from the western bodies. In neither case is the latitude changed, the error in latitude due to the unknown error being eliminated because the observations are on opposite sides of the zenith. The longitude by the respective pairs is affected in opposite directions and by an equal amount.



8. Now take pairs of stars on opposite sides of the meridian, bearing respectively SE. and SW., or NE. and NW. In the same figure the full lines show the correct position, and the dotted lines the observed positions, according as the altitude used is greater or less than the correct altitude; in the former case the lowest dotted intersection (c) gives the observed position from the southern pair of bodies, and the highest intersection (d) the observed position

from the northern pair of bodies; in neither case is the longitude changed, the error in longitude being eliminated because the observations are on opposite sides of the meridian. The latitude by the respective pairs is affected in opposite directions by an equal amount.

9. To eliminate the error both in latitude and longitude we must, therefore, combine in either case both pairs of stars (the NE., SE., SW., and NW. stars all being necessarily used), and we have practically, as in the beginning, that for latitude determinations we must combine observations on opposite sides of the zenith, and for longitude determinations observations on opposite sides of the meridian. The elimination of the error will not be complete unless the pairs of stars are chosen symmetrically; with good conditions, however, the remaining error will be small.

10. From the foregoing, it is plain that circum-meridian observations of the sun are not acceptable for latitude, because, as a rule, we have no suitable body on the opposite side of the zenith to combine with it, and, hence, no means of eliminating the unknown error. Stars must, therefore, be used, there being little trouble in selecting as many pairs as we wish, and, in each case having by our circum-meridian method the benefit of as many altitudes as we wish, thus reducing the accidental or variable errors of observation. It is essential that the sextant stand be used, and, preferably, the inverting telescope.

11. For longitude, also, stars are probably susceptible of the greater accuracy, equal altitudes being preferable, but the sun is generally so much more conveniently used, and the observations, if carefully taken, are withal so accurate, that its use is perfectly legitimate, and leaves little to be desired as to the results. Equal altitudes should be used and several complete sets of observations taken, using in each case both the upper and the lower limb (opening and closing contacts) in order to make the conditions the same in the A.M. and the P.M. observations. This is because our estimation of the contact of the limbs is likely to be different for the opening and the closing contact. The same end of the roof must be towards the observer. The sextant stand should be used, and the inverting telescope, because the more powerful. The sextant should be carefully shielded from the sun when not in use. Comparisons of the hack with *all* the chronometers must, of course, be taken both before and after the observations. It is essential that all the observations and all the comparisons should be by the same ob-

server; the same assistant should also mark, on each occasion, the time on shore. In short, every care should be taken to have all the circumstances of the observations. the same, and, hence, the fixed errors in the same direction; they are thus eliminated from the result, which depends in meridian distances not on the actual values obtained, but on their difference.

12. When the time is limited, or it is desired to complete the observations for position by one trip to the station, circum-meridian observations of stars in pairs may be used, as usual, for latitude, and east and west prime vertical stars for longitude, selecting harmonious pairs and accepting the mean result.

13. As an alternative, a combination of NE., SE., SW., and NW. stars may be used for Sumner lines, and, if symmetrically selected, will give a very accurate result, as heretofore explained. The intersection may be profitably worked out, instead of being found by plotting.

14. It is sometimes forgotten that, in establishing meridian distances, the first and last observations for chronometer error may be at the place to be located, and the intermediate observations at the known place.

POLAR CLIMATE IN TIME THE MAJOR FACTOR IN THE EVOLUTION OF PLANTS AND ANIMALS.

ABSTRACT OF A PAPER

BY

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Under this title the author enters into a field of discussion which has attracted the masters of thought in several branches of science. Astronomy, physics, geology, and biology in its wide sense concern themselves with this problem. Dr. Wieland, as a student of biological science, takes as a fundamental proposition:

> Life, then, as far as we have succeeded in scrutinizing it, is a function of variable mechanical factors combined with chemism, which is fixed, and of climate as dependent mainly on the manner of terrestrial reception of the solar radiant energy. Climate, although following a fairly fixed trend, in itself subject in so far as the globe is concerned to an evolutionary course, is at all times in given localities subject to the accidence of countless movable conditions.

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* Amer. Jour. Sci. XVI, 401–430. Dec., 1903.

Furthermore, his main theorem is,

That the great evolutionary *Schauplatz* was boreal is possible from the astronomical relations, probable from the physical facts, and rendered an established certainty by the unheralded synchronous appearance of the main groups of animals and plants on both sides of the great oceans throughout post-Palæozoic time. Moreover, the efficient cause of this origin in high latitudes of hardy and effective colonizers is to be sought for in the vicissitudes of polar climate as compared with the more equable and static conditions of the tropics.

The author concludes that during geological time the earth's axis has remained so nearly fixed that no changes of climate can be assigned to its variation. The changes in orbital eccentricity have produced the greatest changes in climate, and the changes must have been at a maximum at the poles and at a minimum at the equator. The fossils show that there can have been no glacial periods in the north polar area prior to Miocene time; there must have been instead "prolonged hot, or frosty, or cool, or rainy, or dry seasons." The polar areas, however, have been the scene of steadily increasing climatic change. Adhering to the nebular hypothesis of Kant and Laplace, Dr. Wieland believes that crustal stability must have obtained at the poles long before it did at the equator, and that it is reasonable to conclude that life in its lower forms appeared first at the poles. It is, however, impossible to trace the march of events among the ubiquitous aquatic animals and spore-bearing plants of Palæozoic time, forms which were easy and rapid of distribution.

Mesozoic strata present several fresh-water beds on the continental mainlands, and have preserved the remains of early representatives of the more highly-organized vertebrates and plants. These are delicate horizon-markers, and give clues to the directions of migrations. The earlier expression of the north to south movements of types originating at the far north consists of the fact that the small and delicate so-called mammals of the Jurassic are much alike in beds on both sides of the Atlantic, which are supposed to be of the same age. In the Cretaceous this general fact of migration from north to south is accentuated. Throughout the Tertiary the more nearly complete the record, the greater the parallelism and synchronism in the succession of similar vertebrate faunæ in Europe and America. Wortman was the first to emphasize the great extent of this synchronous succession and its bearing on the question of the polar origin of the main ancestral mammalian stocks.

The facts of the life of oceanic islands show that the dispersion of land vertebrates across ocean barriers is nearly impossible. It is, however, no more conceivable that there was a *constant* inter-

change of vertebrates between America and Europe by way of arctic land masses existing in the Tertiary, because at all times since the earliest Mesozoic the climate prevailing in the Arctic regions would have entailed too many and too great changes in mode of life. The evidence of the fossils themselves is against the theory of austral origin. The only satisfactory hypothesis is that of a common north polar origin of the principal ancestral vertebrate stocks, which dispersed secondarily outwards in waves or impulses from the polar seas and spread over America and Eurasia, and this is sustained through the following reasons:

(a) The parallelism between the life of America and Eurasia is apparently greater than that of the more isolated continental areas of the far south—South Africa, Notogæa, and Neogæa.

(b) The great land masses lie about and project well within the Arctic area, and have therefore afforded the presumably wider geographic range.

(c) There is much reason to believe that the lands near the north pole were always much divided into islands and peninsulas, and were thus, as elsewhere explained, a more active scene of plant and animal change than even a much larger and more isolated body of land such as Antarctica may have been.

(d) It is reasonably certain that over a large portion of the Antarctic area the continuity of life was interrupted by glacial conditions in the Permian.

Turning to the botanical record, Dr. Wieland follows Saporta, and particularly Asa Gray, in holding that the fossils show that there was a universal southward dispersion of plants from the northern polar area during Tertiary time. Dr. Wieland holds, furthermore, that the generalized tropical conditions of early Palæozoic time prevailed in the north even into the early Jurassic. By the mid-Cretaceous the plants give striking evidence of climatic change. The conditions under which the life of a given locality thrives are always, in the long run, retreating southward, and other and hardier forms are always to be found to the northward. Experience has taught the agriculturist that northern varieties of plants are the hardier and that the southern stocks are weaker and even impossible of successful introduction. The same thing applies to animals. Since secular cooling is always going on, and since the general nature of growth is constant, a condition of high northern organic potential must always exist, which results in a southward stress and movement. Life utterly fails to make its way northward again.

Light has had as much effect as heat and moisture in determining the life of plants. All three factors have been variable to the utmost degree in the polar areas, and in the periods of high eccentricity there must have been the most extreme changes and diversities in cloudiness, rainfall, dryness, heat, and frostiness in those re-

gions. The possible difference of thirty-six solar days in the length of the seasons would in many cases produce totally different weather conditions during the periods of reproduction, sometimes favourable, sometimes adverse. Sudden changes of climate or the transportation from warm to much colder localities and *vice versa* result in very obvious changes in animals and plants, but they do not usually leave the stock a vigorous one. As polar changes were mainly governed by the precession of the equinoxes, the time scale was one of 12,934 years for the passing from rigorous to *melior* conditions or the reverse throughout the successive periods of high eccentricity.

Without attempting to follow out further the several lines of evidence of northern origin and of southern migration and displacement, the author considers it fully established that all the factors of climate and, therefore, the main alternative potentialities producing organic evolution have been in the highest degree variant in the polar areas. This being true, the grouping of the continents about the north pole so that they have come to cover fully 300° of the Arctic circle would make it reasonable to suppose that the northern circumpolar area probably has been, ever since the older Palæozoic at least, the main evolutionary centre from which life has radiated. This theoretical view is supported by overwhelming proof that such has been the fact, and that it is from the Arctic area that the greatest waves of change have swept out to lessen and disintegrate, though not necessarily to cease, in the more static conditions of the tropics.

E. O. H.

A CASE OF GEOGRAPHIC INFLUENCE UPON HUMAN AFFAIRS.

BY

GEO. D. HUBBARD.

INTRODUCTION.—Among the geologic questions presented within the bounds of Illinois perhaps none has a greater economic bearing than the glacial problem. It is the purpose of this paper to look at glaciation and its results in a limited portion of Illinois, from the point of view of geographic influence upon plants, crops, and animals, and upon man's distribution, occupations, successes, and failures.

From the studies of the glacialist we may learn that during a not very remote period most of the state was invaded by some of the southern lobes of a continental glacier. An early invasion from the north or northeast advanced almost to the southern limits and retreated, leaving a sheet of rock waste spread over the surface. This drift sheet is known as the Illinoian. Another much more recent invasion covered, approximately, one-third of the state in the northeast corner. During a prolonged halt, at its farthest advance, the melting ice freed quantities of material, which formed a large terminal moraine somewhat concentric with the southern shore-line of Lake Michigan.

After entering the state from Indiana just west of Terre Haute the moraine sweeps westward and then northward along a belt south of Paris, Charleston, and Mattoon, north of Shelbyville, west of Decatur and Clinton, and, after crossing the Illinois river at Peoria, runs northward, then northeastward, blending with others at several points before reaching the Wisconsin line. Upon the completion of this great moraine, called, in its southern portion, the Shelbyville system, the lobe of ice, with many halts, retreated northward and deposited over the surface of drift laid down in earlier invasions a heavy sheet of waste called, near the moraine, the Shelbyville till sheet of the early Wisconsin. Thus, there were spread over the area within the encircling terminal moraine two layers of drift, differing in age as much as the time between the two retreats of the ice which deposited them. The lower of these sheets continued beyond the moraine to the farthest limit of the greatest advance of the ice.

The studies embodied in this paper deal with the terminal moraine and a strip on either side of it wide enough to show the characteristics, both of the old and of the new drift; and while it centres in two adjacent counties the main features of the discussion are applicable to the region near the great terminal moraine from the point where it enters the state from Indiana well toward Wisconsin. In a number of localities the influence of the drift in human affairs has been partly obscured by that of other factors, sometimes geographic, sometimes not.

Many questions of interest have arisen in connection with the work, among which three may be singled out as most fruitful. 1. What was the relief and what were the forms when the ice withdrew and the streams began? 2. What are the present differences between the old and the new drift and drift forms? 3. What influence may these geographic differences be said to have upon

human affairs? For the present the first question must be passed over. The second and third have an intimate relation, and since the latter cannot be discussed without at least a statement of the facts of the former, these last questions will determine the succeeding sections of the article.

SECTION 1.—CHARACTERISTICS OF THE OLD AND THE NEW DRIFT. The great moraine has been crossed in a number of places, ranging from Amboy in the north to Paris in the southeast, and salient points noted, but the investigations have centered around the region from Shelbyville to Paris. The statistical comparisons are made chiefly between Coles and Cumberland counties. The map (Fig. 1) will show the position of the moraine across these and adjacent counties.

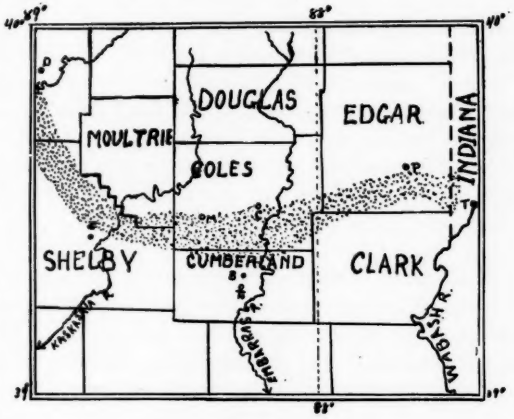

FIGURE 1.

STIPPLED AREA SHELBYVILLE MORAINE.

S = SHELBYVILLE. C = CHARLESTON.
B = BRADBURY. P = PARIS.
TO = TOLEDO. T = TERRE HAUTE.
M = MATTOON. D = DECATUR.

Throughout all this region very marked differences exist between the new and the old drift forms. Although only twenty years ago geologists had not recognized the relations existing here, there are many farmers who have known for a score of years that adjoining counties were quite different in soil, relief, drainage, and crops.

SOIL AND SUBSOIL.—Probably the transition from old to new drift is most easily recognized from the change in the colour of the soil. That of the older drift is light gray, and contains but little organic matter. The subsoil is of a grayish colour, owing to the state of oxidation of the iron. The soil of the moraine and later drift sheet is dark to black, especially if damp; humus is almost universally abundant. The subsoil is a yellow, gravelly, or sandy clay, pass-

ing into blue till below the oxidized zone. The particles of both soil and subsoil are smaller on the south side of the boundary line on similar slopes, presumably due to the greater amount of weathering in the longer period of exposure. The greater degree of fineness is attested on dry, windy days, when the air over the older drift is thick with suspended matter, which may float for a day or more unless forced down by a shower. There are fully twice as many pebbles and boulders in the drift of Cumberland county on similarly situated areas, which means that there were more when the ice first retreated. Those in the moraine and new till sheet are of both igneous and sedimentary origin; but the old drift shows a marked decrease in sedimentary fragments, although both regions are underlain with Coal Measure rocks. However numerous the sedimentary pebbles when the ice retreated, they have had ample time to become disintegrated, for even the igneous rocks are often "rotten" and crumbling. In the new drift most of the specimens of both classes are still sound. These facts largely explain the physical condition of the soil. That of the older or Illinoian is a heavy, rather compact clay, passing below into partially-cemented layers of hardpan; while that of the more recent Shelbyville sheet is a loose, light loam, and much richer in sand.

Dissection.—North of the moraine and upon it, and increasing northward, may be noticed marshes or fresh-water swamps, locally known as *sloughs*, but outside the looping moraine they are almost entirely wanting. The streams have pushed their headwaters back, and have thus claimed nearly all the territory; while within the loop there is much undisputed surface, where water does not run off freely. Many of the marshes have been drained by underground tiling, so that, although the surface waterways are still in a very immature stage, the number of swamps is much reduced. These drained swamps, rich in humus, become within a few years the most valued farming land. Tiling would be useless in the old drift, because the heavy clay soil is so impervious to the water, and it is not much needed, because of the development of the natural drainage. But for crops all through the gravelly soil of the new drift it is a beneficial step.

A further comparison of the valleys on opposite sides of the moraine shows that the little valleys have been pushed back two to four or five times as far from the master streams on one side as on the other. Again, the little valleys are more mature on the old drift than on the new. This comparison must be made at similar

distances from the master streams and between streams similar in size. These facts are best seen from unfrequented by-roads or fields, because they have not avoided the rough country so completely as have the best roads. From a commanding point one can easily see that the country is more dissected in the area of exposed old drift—a characteristic brought strongly home to the writer by

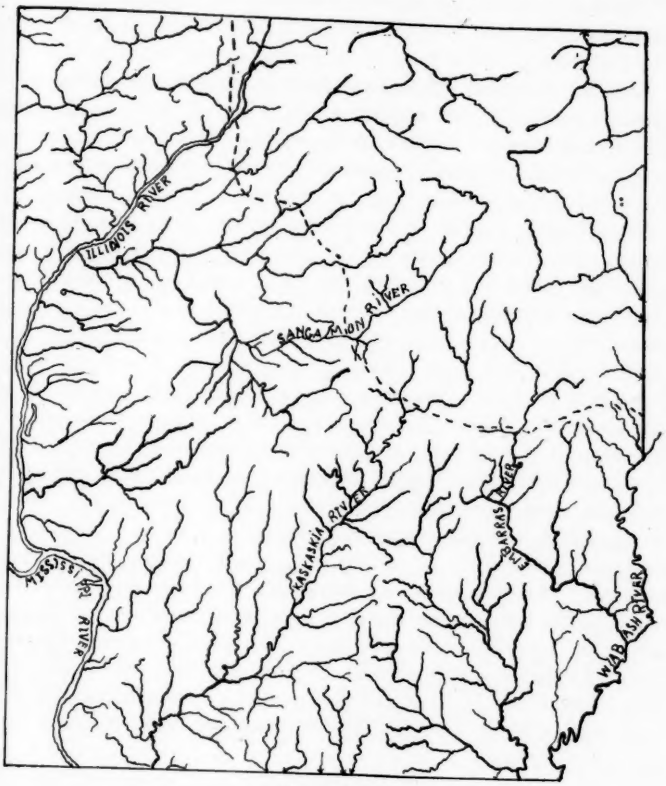

FIGURE 2.

DRAINAGE OF A PORTION OF ILLINOIS. THE BROKEN LINE REPRESENTS THE MEDIAN LINE OF THE LARGE TERMINAL MORAINE.

a hydrographic map of Illinois, one of a series for the Columbian Exposition of Chicago. Most of the common features of a map were omitted, and the streams were printed in black. The increased number of lines for streams south and west of the margin of the new drift gave that portion of the map a darker appearance,

and the position of the terminal moraine could thus be traced with ease.

Fig. 2 is a reproduction of the drainage from a map of the state in Frye's Complete Geography, special Illinois edition. The moraine was located from Leverett's map in the U. S. Geol. Survey, Monog. XXXVIII. The difference in the development of the drainage system on opposite sides of the moraine may be seen at a glance.

SUBSTRUCTURES.—The story told by the substructures as revealed in outcrops and wells is meagre, but certain characteristics are included here. On Indian Creek, about four miles southwest of Charleston, a bluff, recently undercut, exposes sixty feet of clays and sands, with no rock at the base. About halfway down this bluff the character of the till changes from a rather loose, yellowish-blue, gravelly clay to a more compact, less gravelly gray-blue clay. The line between the two layers can be traced across the exposure by the whiter capping of the older drift; but there is no layer of dark, buried soil, as is the case on the Kaskaskia and in several other outcrops. This boundary is not a straight line; it looks as if the upper layer had been laid down upon a rough, uneven surface of the lower. Similar exposures of two or more layers of till north of the moraine help to characterize the country covered with both drift sheets; while exposures south of the moraine, with only the gray-blue layer, mark the country over which the last sheet of drift was not deposited. Sections in wells furnish similar evidence, where a black soil layer, or wood, leaves, and roots are reported. No exposures with more than one layer have been found on the outer side of the moraine loop, and none without manifest evidence of the yellowish-blue layer above the gray-blue within the loop. These features may be held to characterize the old and the new drift. On account of the partial consolidation producing "hard-pan" in the under layer, well-diggers find easier work in the recent till sheet.

Ice-fronts in the moraine belt still well preserved, and the absence of any semblance of such a structure outside, furnish another set of characteristic features. Ice-fronts are not found on the more level till sheet north and east of the moraine, but belong to moraine belts only.

Approaching the Shelbyville moraine along a light-coloured, dusty road across the older drift sheet, one sees the moraine rising as a hilly belt fifty to seventy feet above the more level earlier till

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plain. It looks like a huge dumping-ground. The continued action of rains, frosts, and surface water has rounded off the hummocks, and more or less blended them together. On the other hand, in travelling southward or westward, as the margin of the moraine is approached a vast plain is spread out in view, fifty feet or more below. In tracing the line of contact of the old and new drift many local irregularities are found; sometimes one may identify the two sheets at points a hundred feet apart, but usually it is good work to locate the line within a quarter of a mile. Overwash materials help to mask the boundary, and the line is not straight, but swings in and out. In valleys or low lands the ice seems to have advanced a little farther; while on the higher lands it appears to have been held back a little. (See map, Fig. 1.)

ALONG THE RIVERS.—Embarras river, where it crosses the new drift, usually flows in a post-glacial gorge. This gorge is about one hundred feet deep across the moraine, less deep further north, and is cut in boulder clay nearly all the way; but occasionally the stream, missing the old channel, has cut down into bed rock. This narrow valley has a correspondingly narrow and elongated basin in the region north of the moraine, in part because other streams are near and in part because the headwaters have not claimed all possible territory. Southward in the region of the old drift, the wider valley formed before the Wisconsin drift sheet, and partly filled with overwash materials of Wisconsin age, can easily be traced.

This overwash or valley train partially filling the old valley with drift, usually pretty well sorted, has been cut into by the stream to a depth of about thirty feet, leaving a series of terraces. (See Fig. 3.)

FIGURE 3.

CROSS-SECTION OF OLD AND NEW VALLEYS, THE LATTER WITHIN THE FORMER, JUST SOUTH OF THE MORAINE WHICH CROSSES EMBARRAS RIVER. A–A', BLUFFS OF OLD VALLEY, 1¾ MILES APART. B–B', BLUFFS OF NEW VALLEY, ½–¾ MILE APART AND RISING 30 FEET ABOVE THE STREAM BED.

The old valley is often a mile in width, and from its crest to the bottom of the inner channel more than fifty feet deep; but the stream has not yet cut through the filling, except where it crowds close underneath the bluffs of the old channel. The post-glacial channel varies in width from a half to one mile, and very rarely lies at all

beyond the confines of the older valley. The river, in swinging from side to side, has reached the east bluff in several places, but has not yet disturbed the west bluff. Hence remnants of the surface of the glacial filling are quite continuous for miles on the west side (B′–C, Fig. 3); while they are very fragmentary on the east side (B, Fig. 3). This terrace top is locally known as the "second bottoms," here as in many places in Illinois, in order to distinguish it from the lower present bottoms, or "first bottoms." It is considered superior to the uplands for farm crops, but inferior to the lower bottoms. Practically, all of this terrace seen in the Embarras, and it extends eight or ten miles beyond the moraine, has a front in one step dropping down to the present flood plain. There are similar terraces in gravel trains along many streams in Illinois, where they have just emerged from the terminal moraine into the older drift; and since they do not, and from the nature of the case cannot, occur within the moraine loop, they furnish one more characteristic feature of the old drift. It is unfortunate that so little study has been made of these terrace forms, for they are really common along the streams leading outward across the terminal moraine of the early Wisconsin sheet.

SECTION II.—The influence of these geographic conditions upon values, crops, people, industries, and commerce.

The people dwelling within the loop of the great moraine speak of the southern portion of the State as *Egypt*, and of their own portion as *God's country*. So characteristic are the features of the regions on the two sides of the boundary that all classes of men recognize their unlikeness.

A land agent is authority for the statement that the northern three rows of sections of Cumberland county are worth more than all the rest of the county. These three rows of sections constitute all the land in the county which is not of the older drift, except patches of bottom lands. Real estate men and landholders recognize the geographic boundaries between good and poor land. Geographic influence is a reality which may be expressed in standard terms of value. The records of land transfers, except in the river bottoms, show the average price of land south and west of the great Shelbyville moraine to be not more than $30.00 per acre; many farms sell as low as $15.00; a few for $40.00. North and east of the moraine through many counties the land brings from $75.00 to $125.00 per acre, rarely less than the lower figure, and occasionally more than the higher. But to the cultivator geographic influence is as real a thing as to the taxpayer. Crops are not

the same on opposite sides of the moraine, and on account of the nature of the soil the plows used are of different quality. On the south in Cumberland and adjoining counties lies a region producing timothy hay. Possibly a third of the land is mowed annually. Owing to the large acreage and the smoothness of the country, machinery is extensively used. Straight, round haystacks, in groups or scattered, dot the meadows; rarely is there a hay barn to be seen. Next to hay, stock—cattle and sheep—is the most important product, but many of the cattle are driven a few miles north to be fattened, or are fed with grain from across the moraine. Again, timber is not as scarce in *Egypt*, because the soil is not considered worth clearing for cultivation, and the trees are left in possession. Corn and oats are grown, but are very poor crops compared with those on the new drift. Broomcorn is often tried, with poor success. On the contrary, within the moraine loop is found a characteristically different group of crops. Hay for commerce is rarely grown. Most farms produce enough for their own use, and usually the local markets are supplied from the neighbouring farms. Because of the limited acreage hay-harvesting machinery is little used. Clover hay is more common than timothy. The haystack is rarely seen, because the crop is stored in barns. Corn and oats are the dominant crops, with good and occasionally prodigious yields. The stock is fat, and well fed with the output of the farm. Timber is rarer because the rich soil was worth more for cultivation. Broomcorn in Coles and Douglas counties is a leading crop, and these two counties produce a very large percentage of the total output of the United States. The difference in the quality on opposite sides of the moraine is probably more conspicuous in the case of broomcorn than in that of any other crop. Why such differences in the quality of similar crops? According to the Department of Agriculture, Bureau of Soils (Bull. 22), the economic distribution of crops is dependent mainly upon the physical characteristics of the soil and upon climate. If, as the experiments of the Bureau seem to show, there are but two chief factors, then the physical characteristics are the determining causes of these noted crop dissimilarities, because in two small, adjacent, similar areas the climate is essentially the same.

A table of facts, concerning yield and value of crops in two adjacent counties, has been compiled from the Statistical Atlas of the Twelfth Census, and is inserted here to show the relative strength of Coles and Cumberland counties.

County.	Corn in bu. per acre under corn.	Wheat in bu. per acre under wheat.	Oats in bu. per acre under oats.	Hay in tons per sq. mi. for entire county.	Total value of farm crops per sq. mi. for entire county.	Value of crops per acre of improved land.
Coles.....	30–40	7–14	36 and over.	75–100	$5,000 and over.	$10–15
Cumberland	20–30	less than 7	20–28	100–150	$2,500–5,000	$6–10

According to the same authority, Coles also outranks Cumberland in cattle and swine, but both are similar in horses and sheep.

One is struck with the comparative degree of thrift apparent in each of the two regions. Outside of the moraine many log houses are still in use; while on the inside they have, almost without exception, been replaced by commodious modern dwellings. Buildings are in much better condition—are larger, more convenient, and more numerous within the moraine loop. Abandoned houses are occasionally seen through this district, but they are much less numerous than in the district floored with the older drift. The reasons for abandoned houses are at least two: 1. The owner of the farm has built a new dwelling and has left the old one standing. 2. The partial abandonment of poor farms and the consequent consolidation of two or more under one management. The resident displaced by this means usually leaves the region. In that case the division of farms near towns and their intensive cultivation, together with some centralization of population in the towns, maintains the total population of the entire region from census to census; but the unproductiveness of the farms is an important factor in this last consideration.

The density of population differs remarkably in adjoining counties lying on opposite sides of the outer boundary of the moraine, as is seen in the case of Coles and Cumberland counties in the table below. In 1890, Coles had thirty per cent. more people

County.	Drift.	Area.	Pop. 1890.	Density per sq. mi.	Pop. 1900.	Density per sq. mi.	Percentage of illiterates.
		sq. mi.					
Coles	New	520	30,000	57.7	34,146	65.6	2.24
Cumberland	Old	350	15,443	44.1	16,124	46.1	3.58
Dewitt.....	New	406	17,011	42.0	18,972	46.7	2.21
Logan	Old	610	25,489	41.6	28,680	47.0	4.60

to the square mile than Cumberland; and in 1900 forty-two per cent. more. If a similar comparison be instituted in the adjacent counties to the east, Edgar and Clark, it will not be found to work as well, because the moraine, whose area belongs with the new drift, covers much of Clark county. Furthermore, Clark has productive bottom-lands along the Wabash river. These two advantages place Clark almost on a par with Edgar as to density of population. In 1890 the difference was well marked, but greater development of the bottoms since has balanced up the population. Probably, if the census were sufficiently refined as to minor districts, a comparison of adjacent areas on opposite sides of the moraine might show results tallying with those in the Coles–Cumberland case.

The figures in the table above show the relative standing of two other counties. In spite of the fact that Dewitt has no coal workings, while Logan has coal sufficient to employ several thousands of men, yet Dewitt practically equals Logan in density of population because of its greater soil resources. This, like the Edgar–Clark case, brings out an element which must be reckoned with in the study of results due to complex causes. The geographic distribution of coal, as of any mineral product, is a factor in determining density of population and occupations which here all but obscures the influence exerted by glaciation and subsequent erosion. It is possible for the distribution of coal to be such as not only to obscure the other influence, but to overbalance it, thus introducing an apparent contradiction, until the causes are analysed. But even the distribution of mineral wealth is a geographic factor. In the selection of Coles and Cumberland counties for comparison, a fairly successful elimination of factors other than the one under consideration has been made by nature. Neither county has coal or other valuable mineral deposits; neither has manufactories, except those dependent upon some product of the region, as clays, sorghum, and broomcorn, or those required by the local needs. And no factories except those for making brooms have distant markets. On the other hand, if all crops grown in each county were manufactured in the producing county, certainly the density of population in Coles would undergo a considerable relative increase. In the table concerning population the percentage of illiteracy is entered for each of the counties, bringing out a marked contrast. It is probable that the large proportion of coal miners, mostly foreigners or negroes, is responsible in a measure for the high percentage of illiteracy in Logan county. There is very close agreement between Coles and Dewitt counties, situated in similar

geographic conditions—a correspondence which is at least suggestive.

In the comparison of relative density of population another point may be noted, revealing a physical influence upon occupation. According to the Twelfth Census, Coles county has business enough to support 16,000 of its 34,000 people in towns of about 1,000 persons and upward; while Cumberland has about 3,000 out of its 16,000 people in towns. In the former only about one-half of the entire population lives directly from the soil, permitting the second half to engage in other occupations; while in the latter county four-fifths of the population must till the soil and only one-fifth finds other employment. The contrast is more marked when it is remembered that there are but about two-thirds as many persons to the unit area in Cumberland as in Coles county.

The relative value and importance of exports and imports pertaining to adjacent areas on opposite sides of the glacial boundary seem to confirm the general argument, but figures are wanting.

The influence of environment is clearly felt in road and railroad construction, and is so different in its results as to admit of easy comparison. The abundance of gravel in the hills of the moraine reduces the cost of roads, and there are, accordingly, many miles of well-gravelled roads in Coles county, especially in the southern half. In Cumberland there is very little available road material, and the heavy clay makes good roads possible without gravel. Away from the moraines of the new drift there is little gravel, and the roads, over the black, sticky, rich earth, become in rainy weather almost impassable. North and east of the moraine railroads cost less for grading, cutting and bridging than they do south and west of it. The greatest expense for these items is where the road is laid among the morainic hills.

CONCLUSION.—Well does Professor Davis say*: "The vanished ice sheets are of greater importance in American geography than are the Indians in American history." We cannot accurately tell what would have been the condition of the country had the glacier not visited it, but upon the glaciated parts we can see that the effects vary greatly even within narrow territorial limits. Whatever the origin of the so-called Illinoian drift and whenever it came with reference to the Wisconsin sheet, the present geographic conditions on opposite sides of their common boundary have given rise to differences in crops and in values, in

*Text book in Physical Geography, p. 346.

the cost and facility of road and railroad construction, in the occupations and thrift of the inhabitants, and even in the distribution and density of the population.

Cornell University.

A PICTURE OF KANO.

One of the photographs illustrating the important paper by Brigadier-General Sir F. D. Lugard, on "Northern Nigeria," in the January number of *The Geographical Journal*, gives a bird's-eye view of Kano, the chief city of the Central Sudan. The picture is here reproduced. It was taken from Dallah Hill, which is far within the city wall, and the view shows nothing of this stupendous structure, which, Sir Frederick Lugard says, is 30 to 50 feet in height, 40 feet thick at the base, is pierced by 13 gates, and has a length of 11 miles.

Barth also stood on Dallah Hill when, in February, 1850, he made the sketch of Kano that appears in his great work. The hill is to the north of the inhabited part of the city, and the view before us stretches away to the south, but does not clearly present the southern part of the town. The long, narrow pond appears exactly where one would expect to see it after studying Barth's map. Beyond the pond we see no distinct feature of the city, though two-thirds of it, according to Barth, is south of this sheet of water.

Captain Clapperton visited the city in 1826; but Dr. Barth, who visited all the great cities of Bornu and Hausaland, was the first to describe Kano. He estimated its population at 30,000, but Clapperton gave a higher figure. The city was captured by the British early last year. The brief description of Kano, given by Sir Frederick Lugard in his paper, is printed below:

> Kano alone, among the cities of Africa which I have seen, with the exception of Katsena, is worthy of the name of city, for its houses are of solid mud, with flat roofs impervious to fire, and lasting through the centuries, instead of the beehive-shaped huts of the populous towns of the south. Traces of Moorish architecture are visible everywhere, and the horseshoe arch, which some writers assert was introduced by the Arabs from Syria and Mesopotamia, modified by the Berbers and Egyptians, is a feature of the buildings.
>
> I took up my quarters in the small hall of audience, a room 25 feet square,

18 feet high, decorated with quaint shapes and designs in black, white, pale green, and yellow—the latter formed of micaceous sand, which glistens like gold. The dome-shaped roof is supported by twenty arches, all of mud, but admirably fashioned, and converging on the centre . . . . Kano thus marks the limit of the northern type of building, of which only occasional reminiscences are seen in some emir or chief's house in Zaria and Bida.

Admirable in design as were the great houses of the king and chiefs of Uganda before the Pax Britannica taught the people to prefer architecture of the railway-shed pattern, they were but of grass and palm-stems, which a fire would destroy in a night; but the greatest fire would leave Kano intact as a city. The city is divided,

KANO FROM DALLAH HILL.

like all others in Nigeria, into quarters where the different races congregate, and it is striking to see whitefaced Tripoli merchants with their wares of tea and sugar, silk and spices, in the Arab quarter of this African city. There are large open spaces everywhere in Kano, each with its enormous hole of reeking sewage, from whence the clay has been dug to build the houses. Unlike Bida, which, as you approach it, looks like a forest, Kano is almost treeless. Over these bare spaces sweeps the dusty wind, and on the margins of the great holes or stagnant tanks the vultures fight for the carcase of some dead dog or the stray leg of a bygone fowl.

The great market is said to contain a floating population of 30,000 persons, and camels, horses, asses, oxen and goats are exposed for sale. Tripoli merchants, Asbenawa from the desert, Salaga merchants from the Gold Coast, and Hausas each sell their own particular class of wares. I would linger here and describe to you this interesting town, the nature of the trade, and the history of its people, but I must pass on with my narrative. Suffice it to say that in an Arabic document obtained by Mr. Wallace some years ago, I find that the history of forty-two kings of Kano is given, covering a period of 768 years. The manuscript breaks off suddenly, and it

is not possible to fix with accuracy the date of the events it records, but the last king is probably identical with the man whom the Fulani ousted, which would carry back the history to 1040 A.D.

Later documents thus assign to the city greater antiquity than was conjectured by Barth, who, on the authority of Leo Africanus, expressed the opinion that early in the sixteenth century there was nothing of Kano excepting a fort on Dallah Hill.

GEOGRAPHICAL RECORD.

AMERICA.

THE CONTINENTAL PENEPLAIN OF NORTHEASTERN NORTH AMERICA.—The Laurentian Peneplain, proposed by Dr. A. W. G. Wilson (Journal of Geology, Vol. XI, No. 7, October–November, 1903), comprises the ancient crystalline area of northeastern North America, or nearly one-fourth of the continent, including all of eastern British America, Baffin Land, the Coast of Greenland, Newfoundland, the Adirondacks, and the crystalline belt of Lake Superior. This physiographic unit, the author states,

"extends through 58 degrees of longitude and 23 degrees of latitude, covering in all an area of over two million square miles." It is "not a single plain but rather made up of a series of facets intersecting at very low angles, three of which are distinguishable south of the main divide, so there are probably five facets and perhaps more."

This shield, the Canadian old land, has never been wholly submerged since the close of the Algonkian. In this long period denudation has reduced the area so nearly to base level that the surface presents the truncated stubs of intensely metamorphosed igneous and sedimentary rocks, evidently once deeply buried. Paleozoic sediments, revealed resting on the modified peneplain surface, indicate that the plantation, which was doubtless chiefly subaërial, took place before that period. The features of a plantation surface most evident are the even skyline and the low gradient of the surface. Between the Great Lakes and the Arctic elevations of over 50 feet are rare, and heights of 100 feet stand as landmarks; while levels on the peneplain, run along streams, lakes, and railways for distances of 300, 450, and 300 miles, show an average grade of 2.8, 1.8, and one foot to the mile respectively. This may be compared with the levels run along the railways on the Great Plains, which show a gradient varying from 2.1 to 3.8 feet to the mile. Departures from the normal peneplain type are exhibited

in the absence of residual soil, which glaciation has swept from the surface, the departure of the drainage from the mature type, and innumerable lakes, also ascribed to glacial modification.

The elevations, such as the narrow belt of mountains which rises 4,000 to 6,000 feet in Labrador, scattered residual peaks of less than 800 feet elevation over the entire area, Trembling Mountain near Montreal, the Baraboo Ridge of Wisconsin, and the Adirondacks—all are monadnocks. The topographic depressions are (*a*) broad, shallow depressions between hummocky and undulating ridges, probably mainly of contemporary origin and due to differential erosion of the peneplain surface *plus* subsequent denudation; (*b*) depressions containing sedimentary deposits of Cambrian or Paleozoic age, perhaps faulted down as *graben;* and (*c*) gorge and cañon valleys, incised near the peneplain margin, the type of which is the ice-eroded fiord of the Saguenay. The region is now, the author concludes, in the youthful stage of a new geographic cycle.

One cannot but feel admiration for the analytical power and keen eye that thus trace back and portray the history of a continental area, a large portion of which has never been mapped, which has only been crossed in a few places, large reaches of which have never felt the tread of the foot of civilized man, and only a moiety of which the author has visited. L. M.

Forthcoming Geologic Folios.—The Feb. 1st, 1904, index map of U. S. Geological Survey topographic sheets in the Middle Atlantic States indicates that almost all of New York State is mapped. Except a small area near Chautauqua Lake and the region about Ogdensburg along the St. Lawrence, in all about 20 quadrangles, all the primary control work and part of the field work is now completed, 21 sheets are now in course of publication, and 146 sheets have already been issued. At no distant date a map of any portion of the State will be accessible.

The series of geologic folios, on the eastern boundary of New York, which are not yet published; although the field work is completed, promises much to those interested in physiography. This series, which includes five four-sheet folios, partly in Connecticut, Massachusetts, and Vermont, and partly in New York, extends from near Waterbury, Ct., nearly up to Port Henry on Lake Champlain. Following the line of the irregular Lake Champlain and of the deep Berkshire Valley, and cutting diagonally across the N. W.–S. E. axis of ice movement, this series of folios will together constitute an attractive physiographic study. It will be interesting to see

what disposition the authors of the various folios make of several mooted questions.

There are five other folios in the State, all scattered and each presenting a different type of region. One, the New York City Special, is already published. On the others the field work is completed.

There is a four-sheet folio, northwest of the series just mentioned, in the region of the highest Adirondacks. There is a four-sheet folio just east of Niagara Falls, including parts of the two plains, separated by the Niagara escarpment. There is a two-sheet folio, including the Olean and Salamanca sheets and lying just north of Pennsylvania. Finally, there is the four-sheet Watkins Glen folio, which includes the lower ends of the two largest Finger Lakes and the upper headwaters of the Susquehanna. This folio is especially important, because it lies in the region of Cayuga and Seneca Lakes, a country rich in gorges and waterfalls, and near an important educational centre, Cornell University. This and the folios north and east of it, when prepared, should, therefore, be of the highest value to students of physiography in that institution. The mature upland, deeply dissected, with the deep, winding Finger Lakes, and the higher hills near the Pennsylvania boundary, presents drainage problems that are perplexing, the solving of which will be of the utmost value. L. M.

Changes of Level at Cape Ann, Massachusetts.—A drowned seacoast, like that of New England, is not difficult to recognize, but evidences of greater depression than now exists are not common enough to be passed by without remark, nor are the criteria for the identification of such former levels as yet established. Professor Tarr (Bull. Mus. Comp. Zoöl., Vol. XLII, September, 1903) presents evidence of a preglacial stand at Cape Ann at a lower level than the present, and establishes his point by the aid of indisputable collateral evidence. The Cape is a granite boss, partly covered by morainic deposits; but at levels below 40–60 feet the glacial deposits have been stripped away, leaving bare granite rock with perched boulders and extensive areas of stratified deposits. This stripped area, as previously shown by Shaler, is interpreted as sea-washed. Additional evidence of former post-glacial depression of this region is found in the presence of an area of sand dunes no longer in movement, and in a position where good supply is not possible at the present stand of the land. The dunes have long been unmoved, the sands are discoloured by iron oxide, and a

forest grows on them. Besides an elevated sea cave and deposits of stratified drift of no definite form, but confined to the horizon between the 40 and 60 foot contours, there are delta deposits, and numerous beaches and gravel bars of indisputable character at about 60 feet above sea-level; but nowhere are marine fossils found in them.

A portion of the paper is devoted to a description of a fossiliferous series of clays and sands underlying glacial till and interpreted as probably interglacial. These beds had previously been discovered by Professor Shaler, but recent cuts have clearly shown their characteristics and relation to the overlying till. The till rests on them unconformably, and the strata are folded and faulted, evidently as a result of the ice thrust. The clays contain large boulders, indicating drift ice, which could scarcely have brought them in water having a depth of less than 100 feet. That these clays were formed in cold ocean water is proved by the fossils, such as *Yoldia siliqua*, *Aphrodite groenlandica*, and others, now no longer living in the waters of this region, but abundant in the waters of the Arctic. The fossil-bearing bed is from 15 to 20 feet above mean sea-level, and the marine deposit beds extend fully 10 feet higher, indicating subsidence during their formation fully 30 feet below the present level.

In a note appended to this paper J. B. Woodworth describes beaches and other evidences of wave-action on a part of this same promontory at levels between 60 and 80 feet. His observations are in accord with those presented by Professor Tarr. L. M.

THE ANDOVER DELTA-PLAIN.—The "Indian Ridges" of eastern Massachusetts are so nearly classical ground to the glacial geologist that any contribution relating to them, even though an exceedingly specialized local study, is of interest. A recent paper by Professor F. S. Mills of St. Lawrence University (American Geologist, Vol. XXXII, September, 1903), on the Andover Delta-Plain, describes an interesting deposit in this region, and contains a plea, based on rational premises, for the name delta-plain in place of sandplain. Mills bases this plea for the adoption of Professor Davis's name on the ground that sandplain is incongruous, delta-plain both descriptive and generically true.

The delta-plain described is situated near Ballardvale, 23 miles north of Boston. It is a typical level-topped, cuspate mass of gravel and sand, a mile by a mile and a half in area. Sections reveal back-set beds where the stream, emerging from the ice-front,

had to ascend over its own accumulations. Lenses of unstratified material, probably dropped by icebergs, and a gradation of material from ice-contact to front, were noted. The plain was probably built quickly, the glacial lakelet overflowing southward for a while; but withdrawal of the ice reversed the drainage into the Merrimac. An esker feeds the delta-plain, changing northward into a broad, indefinite kame area (Stone's "plexus"), then, resuming the definite ridge form of an esker, crosses the Shawsheen River, and joins the "Indian Ridges," from which a great esker extends northward into New Hampshire. Mills publishes excellent half-tones of the delta-plain and of sections in it. L. M.

Mount Monadnock.—The use of the term *monadnock*, introduced by Professor Davis as the name for a peak rising well above the general level of a surrounding peneplain, has attracted to Mt. Monadnock, in southern New Hampshire, an interest far greater than would normally belong to a small peak in a remote region. In a recent number of the Journal of Geology (XII, 1904, 1–14) Perry describes the geology of this peak in some detail. He finds it to be a syncline of andalusite-fibrolite schist, probably of Carboniferous age, with granite around the base. To the physiographer the most interesting part of Perry's paper is his brief consideration of the reason for the decided elevation of Monadnock above the surrounding lowlands. He states that there is nothing about these rocks to indicate that they are more resistant than the surrounding granites and schists. This leaves as the only explanation of the elevation of Monadnock its location on the eastern preglacial divide of the Connecticut Valley. To those who question the application of the peneplain theory to the uplands of New England this conclusion of Perry's is of decided interest. It is exactly what one would expect to be the case on the theory of bevelling, by which, instead of a general peneplain, the region is believed to have been reduced to a hilly and low mountain region of decided irregularity, retaining greatest elevation along the divides. How such a region of decided elevation as that of Monadnock could have stood up through the enormously long period of time required for general peneplanation, unless it is a region of much more resistant rock, is exceedingly difficult to understand. R. S. T.

The Physiography of the Tennessee River Valley.—In the southern Appalachians there is a peculiar condition of drainage where the Tennessee, just below Chattanooga, leaves the broadly-

open Appalachian valley, turning abruptly westward and crossing the plateau in a deep, narrow gorge. Why the river should not continue on in the broad valley, where the divide between the Coosa and the Tennessee is very low, has been a question of interest to physiographers. Several years ago Hayes and Campbell proposed as an answer to this question the theory that, up to late Tertiary time, a river, the Appalachian River, actually did occupy this valley, entering the Gulf along the line of the present Coosa valley. Stream capture from the west has led the upper part of the Appalachian River (the present Tennessee) westward across the plateau.

In a recent paper (Journal of Geology, XII, 1904, 34–39), Mr. Charles H. White questions this theory on several grounds, and proposes in its place the theory of an original west-flowing drainage from the Great Smoky Mountains across the Appalachian valley and the plateau. The region was lowered to the condition of a peneplain and the streams developed a meandering course, one of the meanders being preserved in the swinging course of the Walden gorge. With uplift of the peneplain the Tennessee sunk its gorge in the plateau, and broadened its valley in the weaker strata of the Appalachian valley, increasing its extent by headwater capture until all the transverse streams had been led off through the Tennessee gorge. Further development of headwater capture, greater in south-flowing than in north-flowing streams because of greater uplift in the northern part, threatens capture of the Tennessee, leading it southward along the Appalachian valley directly to the Gulf. According to White's explanation, therefore, the Tennessee, instead of having captured a part of an Appalachian river, is in danger of being captured itself by an Appalachian river still in process of development. R. S. T.

The Upper Kern Basin, California.—An excursion of the Sierra Club to the Upper Kern Basin, California, in the summer of 1903, gave to Professor A. C. Lawson opportunity for some interesting studies in the high sierras, which he has recently published (Bull. Dept. Geol. Univ. of California, Vol. 3, 1904, pp. 291–376) under the title of "The Geomorphogeny of the Upper Kern Basin." The region is one of massive granite, crossed by an exceedingly well-developed series of joint planes, which have had a profound influence on the topography. The uplands attain a moderate degree of uniformity of level, such as would lead most physiographers at once to pronounce the region a dissected pene-

plain; and we have come to expect so confidently such an interpretation of this phenomenon that it is a surprise and encouragement to find a physiographer of Lawson's rank proposing another explanation. His hypothesis is that the great granite intrusion was arched over by sedimentary strata, nearly all of which have been removed, and that the present upland surface had its level determined by this discordance between weak sedimentary strata and resistant granite.

Kern River occupies a cañon in this granite mass which Lawson assigns to rifting or the opening of fissures in the granite parallel to the course of the cañon. Only a small part of the cañon is to be accounted for by block-faulting, or the "engulfment of *graben* wedges or slabs," but most of it by stream erosion directed by the rifts. R. S. T.

Glaciation of the Kern Basin, California.—In his study of the physiography of the Kern Basin, Lawson discusses also the subject of former glaciation and its effects, a valley glacier developed in the basin attaining a maximum length of twenty-four miles from the head of the cañon and receiving numerous tributaries. The glacier had little effect in widening or deepening the cañon, but Lawson believes that glaciation had a profound influence on the formation of cirques and on the sharpening of mountain divides and the lowering of mountain crests, in this following Johnson (Science, N. S., Vol. 9, pp. 112–3) and Matthes (21st Ann'l Rept. U. S. Geol. Surv., 1899–00, Part II, p. 167). The cirques usually occur on both sides of a mountain crest, and their enlargement at first forms a narrow ridge, and finally a low, level col or pass. Lawson goes to an extreme in the application of the principle of cirque enlargement when he indulges in the speculation that it would not only remove the mountain tops, but that "Glaciation in the high mountains, in so far as it depends on altitude, is, therefore, a process which automatically terminates" by so lowering the mountain as to make further glaciation impossible. The entire subject of cirque formation is one well worthy of extended comparative study to determine how much of it is due to glacial work and how much to the normal processes of frost action, sapping, and other forms of subaërial denudation at valley heads in lofty mountains, especially in regions of crystalline rock. R. S. T.

Physiography of Washington.—In a recent professional paper (No. 19, 1903) of the U. S. Geological Survey there are two con-

tributions on the physiography of the State of Washington, one by G. O. Smith on Central Washington, the other by B. Willis on the Wenatchee-Chelan district of the Cascade Range. In each paper there is a description of the general physiography of the region and an interpretation of the principal physiographic phenomena.

According to Smith's interpretation the Central Washington region is an extensive peneplain, deformed, even to the extent of forming anticlinal mountain ridges and synclinal valleys. The deformation has resulted from at least two distinct periods of crustal movement, and the region has been extensively dissected by denudation, especially in the Cascade Ranges. Following Russell, Smith interprets the Yakima River as an antecedent river of exceptionally fine type, which has maintained its course across several uplifted ridges. The original meanders of the river are preserved in the deep cañon which the Yakima occupies in its course across these ridges. The uplift of the ridges was not sufficiently rapid so to dam the Yakima as to force it to seek a new channel.

Willis also recognizes the peneplanation, but with more complex history. The readiness with which this physiographer picks out from the maze of mountains the several stages of physiographic history cannot but challenge admiration for the keenness of his observation and the power of his constructive imagination. Yet it could be desired that he had given to alternate hypotheses as thorough consideration as he has to peneplanation, or, if he has, that he should have published his analysis. But this is an age of peneplains, and it is well known that the pendulum of scientific adherence to hypotheses often swings far to one side. The reviewer is wondering when the pendulum of peneplain interpretation will commence to swing back toward a more normal position.

Among other phenomena considered in Willis' paper is the remarkable valley of Lake Chelan, which he describes and interprets. He agrees with Gannett in interpreting the unusual character and depth of the Chelan Valley as the result chiefly of glacial erosion. The valley had a large volume of ice tributary to it from mountains 350 square miles in area, attaining altitudes of 7,000 to 8,500 feet. The ice was forced through a mountain cañon of remarkable depth and narrowness, and is believed to have eroded the valley to its present depth, which, through a distance of 16 miles, exceeds 1,000 feet, and in one place is 1,419 feet, or 340 feet below sea-level. R. S. T.

BRAZILIAN TOPOGRAPHIC MAPS.—The Brazilian State of São Paulo, of which an American, Professor O. A. Derby, is Chief Geographer and Geologist, has issued a number of topographic contour maps of its area, most of the State having been already mapped. The sheets are on the scale of 1:100,000, with a contour interval of 25 metres, and are not less good than we should expect from a survey of which Professor Derby is the director. They differ in no important essential from the topographic sheets of the U. S. Geological Survey.

The São Paulo sheet, containing the seaport Santos, and the capital, São Paulo, with the railway, which ascends 3,000 feet in nine miles, presents interesting physiographic phenomena. A drowned coast, with lofty mountains, is backed by a plain whose drainage is so sluggish that swamp conditions obtain in all the stream valleys. The short east-flowing streams, descending precipitously to the sea, with high grade and abundant cutting tools, have carved deep gorges; and their headwaters promise, at no distant date, to carry off to the high seas the pirated waters of members of the leisurely-inclined drainage system of the level plain above. The country looks intensely interesting to the physiographer, and we shall look forward with expectations of valuable contributions to the further publications of a survey whose detailed mapping is to be based on so excellent a foundation. L. M.

EUROPE.

THE SIMPLON TUNNEL.—This great engineering work is rapidly approaching completion. The tunnel will be a little over 12¼ miles in length, of which about 11 miles are now completed. The boring of the Simplon was decided upon by Italy and Switzerland, the two countries voting $15,054,000 to carry out the work, which began in November, 1898, and was to be finished within five years. Great difficulties have recently been experienced, on account of the immense amount of water entering the tunnel. A new plant of pumping machinery had to be installed, and, as a result, the contractors have asked for an indemnity from the two Governments. The opening of the tunnel will directly connect the English Channel and the Adriatic Sea, and it will be the only route to compete with the St. Gothard tunnel. It will give the shortest line between England, Milan, and Brindisi, and, naturally, the Indian mail will travel by this route.

TRAVELLING IN DISGUISE IN TURKEY.—Gottfried Stransky, of Austria, spent about two months, in the summer of 1903, travelling

through eastern Albania and a part of Macedonia. The region visited is not very well known, and the journey might have been fruitful in geographical results if the political conditions had been better. It was necessary to travel in disguise, and so Mr. Stransky assumed the name of Jussuf Effendi, wore a white fez, carried a pack on his back, and gave himself out as a Turk from Constantinople. His acquaintance with the Turkish, Bulgarian, and Greek languages and his assumption of the *rôle* of a very poor man collecting insects, to sell them to a museum, enabled him to make a journey that was rich in experiences, though poor in scientific aspects. The description of his journey appears in the *Mitteilungen* of the Geographical Society in Vienna, Vol. XLVI, Nos. 11 and 12.

ASIA.

Economic Development in Sechuan.—Lieut.-Col. C. C. Manifold, who has recently travelled extensively in Central and Western China, has an interesting paper in *The Geographical Journal* (March, 1904), largely devoted to the rich province of Sechuan. Though one trading steamer, the *Pioneer*, has successfully ascended the rapids from Ichang, the head of navigation for large vessels on the Yangtse, to Chung-king, the capital of Sechuan, it remains to be proved that steam navigation through these gorges can be made a profitable commercial enterprise. The western part of Sechuan is a wild, inhospitable region of high mountain ranges, with limited agricultural resources, and rivers too impetuous for junk navigation. It possesses great wealth in unworked deposits of the precious metals. The eastern part of the province has an area of nearly 70,000 square miles, a population approaching 50,000,000, and, though originally a plateau of soft red sandstone, it has now been worn down into a rich, fertile country of innumerable small valleys, bordered by hills, whose sides are terraced with fields to their summits. The whole country is under the closest cultivation, and parts of it support the densest population, to the square mile, that is to be found in any agricultural area in the world.* In many places two crops are grown in the year, and the soil is kept in a

* Lieut.-Col. Manifold's figure for population does not agree with that given by the *Statesman's Year-Book*, 68,724,890 for the 218,480 sq. miles of Sechuan, and it greatly exceeds the cautious estimate of 45,210,000 in the *Almanach de Gotha*. The statement as to the density of population in parts of Sechuan can hardly be accepted, in the absence of data to dispute the supremacy of Barbados, with 1,178 inhabitants to the square mile.

Editor Bulletin.

condition of high productiveness by fertilizers, whose value is fully appreciated.

The country has a great future, for it is uncommonly favoured with coal and iron deposits, in addition to gold, copper, petroleum, and salt. Silk, wool, and hemp are manufactured to a large extent, and the textile industries are capable of a great development. The manufacture of paper and the production of oil, sugar, etc., are large, and rapidly increasing. Another blessing of the province is an abundance of cheap and skilled labour.

In his journey across China from the sea to Yünnan, the explorer remarked the decay of Buddhist temples and monasteries nearly all over the land. He says that, except in Mongolia and the extreme west of China, the observance of Buddhist rites is rapidly declining.

AFRICA.

Surveys in Northern Nigeria.—The London *Times* says that a party left England on Feb. 28, under the leadership of Lieut. Boyd Alexander, for West Africa, to conduct a survey of the eastern portions of the Northern Nigeria Protectorate. The expedition will ascend the Niger to Lokoja, travel up the Benue, and finally across the country northeast to Lake Chad. Specially-constructed steel boats for the navigation of shallow rivers were taken. The party will probably not return to England for two years.

In his address before the Royal Geographical Society on Nov. 4 last, Sir F. D. Lugard, High Commissioner of the Protectorate, spoke of the need of continuing the surveys and of ascertaining the exact positions of important towns throughout the country. He added that the exploration of the Kaduna and Gongola tributaries of the Benue is likely to have an important practical bearing on the development of the country. Mr. Moran has proved that the Gongola is navigable for a short time when in flood, as far as Gombe, and may be utilized to push telegraph and building material and other stores northward without incurring the great expense of land portage.

Administrative Divisions of the French Congo.—The French Congo is too large to be governed from one or two administrative centres, and for this reason the Government has divided it into four distinct districts. The colony of Gabon, comprised between Spanish Guinea, the Cameroons, and the Congo basin, will constitute a colony directed by a Lieutenant Governor residing at Libreville. The Middle Congo, extending south and east of

Gabon and limited on the east by the Congo and the Mobangi Rivers, will be a colony under the authority of a Commissioner. The Mobangi-Shari, comprising the region to the north and east of the River Congo and limited to the north by the seventh parallel and the Egyptian Sudan, will be a territory administered by a delegate of the Commissioner General residing at Bangui. The Territory of the Chad will comprise all the region to the north of the Mobangi-Shari, as far as the Sahara desert, which is under the influence of France. It will be governed by the officer commanding the troops stationed in this territory.

OCEANIA.

EXPLORING THE LARGEST ISLAND OF THE NEW HEBRIDES.—In August, 1901, a party of Frenchmen explored Espiritu Santo, the largest and most northern island of the New Hebrides group. This island was discovered three centuries ago by the Portuguese sailor Queiros, who gave it the name it bears. He believed it to be a part of the reputed great southern continent. He landed on its northern shores in the deep Bay of St. Philippe and St. Jacques, but since that day, May 1, 1606, the island had remained almost unknown. It embraces about one-fourth of the area of the entire archipelago. The facts about the recent exploration, with a map of the island, were communicated to the Lisbon Geographical Society (*Boletim*, Nov., 1903) by its corresponding member, George Collingridge of Australia.

The party numbered about thirty men, chiefly French colonists of Vaté, and other islands of the group and a number of Kanakas. They started inland from Segond Channel, on the south coast, to cross the high plateaux of the interior to St. Philippe Bay, on the north coast. Mr. Largeau led the party, and Mr. Ollivier was naturalist and botanist.

The party forced their way north with difficulty through the thick undergrowth, tracing the meanders of the swift River Sarakata, the largest stream of the island. The natives fled before them to the interior. On the third day they approached the mountain retreat of Chief Leo, noted for his cruelty, and sent a messenger to inquire how he intended to receive them. As he sent no answer, they ascended his mountain with some solicitude, but found him very ill. The doctor of the party relieved his distress, and the white men were well treated. Pushing northward to a high plateau in the heart of the island, they enjoyed the fine climate at this elevation (figures not given) and the splendid panorama of the Sarakata valley.

Chief Sanapo, in this region, wished them to join him in war on a neighbouring tribe which had stolen one of his women. He could not be made to understand why the French would not take part in his quarrel, and he left them in a sullen mood.

They found that the west of the island is traversed by a mountain chain extending north and south, its culminating summit, at its southern termination, being 5,520 feet high. Another chain from the northwest of the island crosses it diagonally to the southern end of the western mountains, and forms the water-parting between the Sarakata, the Belchif, and other south-flowing rivers and the Jordan and other small rivers flowing north and emptying into the Bay of St. Philippe and St. Jacques.

POLAR.

Ice Conditions in the Arctic Seas in 1903.—The Danish Meteorological Institute has just issued its annual *Report* on the state of the ice in the Arctic seas. It covers the year 1903, and presents five maps showing the ice conditions as far as they could be ascertained for each month, from April to August, inclusive. The conditions in Barents Sea were generally unfavourable throughout the summer, except in the waters around Bear Island, which were ice free from the beginning of April. Off South West Land and in Storfiord, Spitzbergen, the state of the ice was unfavourable, owing to the large quantity from east Spitzbergen. North Land was inaccessible until late in July.

On the coast of East Greenland the breadth of the ice-belt north of Jan Mayen was normal until August, when it greatly diminished. At Angmagsalik, further south, the ice conditions were unusually favourable through June, July, and August, and the sea was quite ice free in August. Around Iceland the state of the ice was about normal.

Icebergs in the spring and summer were more abundant than for many years. The Labrador current brought into the temperate seas an unusually large number of them. The sea ice drifting south from the polar ocean into the North Atlantic was about normal in quantity. Melville Bay, on the west coast of Greenland, was filled with pack-ice until the middle of August, and two whaling steamers were prevented from reaching the fishing ground in the western part of Baffin Bay. Cape York was attained by the whalers on June 26.

The condition of the ice in Bering Sea was unfavourable throughout May, but both the eastern and western passages were

navigable early in June, and Bering Strait about June 20. During August and September pack-ice lay from one to ten miles from the shore, between Point Barrow and the mouth of the Mackenzie River. The Institute repeats its appeal to all voyagers in the Arctic regions to forwârd all obtainable details for 1904 to its office in Copenhagen.

A RUSSIAN ARCTIC EXPEDITION.—*Nature* says that the St. Petersburg Physico-Chemical Society intends to send out an Arctic expedition for the observation of solar radiation and atmospheric refraction of cloud movements and of atmospheric electricity, in connection with the extinction of the ultra-violet light; also, for the determination of the phenomena of terrestrial magnetism and of electric currents in the ocean, for chemical analyses of the composition of the air and water, and for the examination of the polar ice.

SCIENTIFIC STATION ON THE ANTARCTIC.—By an arrangement between Mr. Bruce, leader of the Scottish National Antarctic Expedition, and the Argentine Government, the magnetic and meteorological station established by Mr. Bruce at Scotia Bay, in the South Orkneys, is to be continued by the latter. The buildings have been handed over to the Argentine Government, with provisions for eighteen months, and when Mr. Bruce returned south he took with him three Argentine scientists to man the station. The Argentine Government has offered the position of chief of the station to Mr. Robert C. Mossman. The results of the observations will be published by the Argentine Meteorological Office (*Scot. Geog. Mag.*, March, 1904).

NEW MAPS.

AMERICA.

SOUTHERN PATAGONIA AND TIERRA DEL FUEGO.—The Land of Magallanes. Illustrating a paper by W. S. Barclay on the Fuegian tribes. Natural scale, 1:2,000,000, or 31.56 statute miles to an inch. *The Geographical Journal*, Jan., 1904. Shows by colors the habitat of the Ona Indians on the plains of eastern Tierra del Fuego, of the Alacaluf Indians along the western coasts of that island (Cape Horn and Beagle Channel), and of the Yahgan Indians along both shores of the western half of Magellan Strait. According to Mr. Barclay, these tribes are smaller than has usually been supposed. The Onas number about 600, and live entirely on land; the Alacalufs, nearly 800, live partly in canoes, partly on land; and the Yahgans, under 200, entirely canoe-dwellers.

UNITED STATES.—Economic Map of the Yukon River, Alaska. Scale, about fifty statute miles to an inch. By Arthur J. Collier. (Bulletin 218, U. S. Geological Survey.) Washington, D. C., 1903.

Shows the distribution of the coal-bearing rocks along the Yukon from Dawson to the mouth of the river. Eight coal mines and seven coal prospects are indicated between Forty Mile, near the International Boundary, and Anvik, on the lower river. All the Yukon coal of commercial importance is of Cretaceous or Tertiary age, but it has not been found feasible, as yet, to differentiate the Cretaceous from the Tertiary coals. The map also shows the areas of non-coal-bearing rocks as far as known.

UNITED STATES.—Geological Reconnaissance map of Nevada south of the 40th parallel and adjacent California. Scale, about 14.5 miles to an inch. By J. E. Spurr. (Bulletin 208, U. S. Geological Survey.) Washington, 1903.

The map illustrates what is known of the geology of Nevada south of the 40th parallel, and is based upon Mr. Spurr's own journey in 1899, the Wheeler and Fortieth Parallel surveys and the routes of Emmons, Gilbert, Turner's reconnaissance map and the very recent journeys of Weeks and Rowe. While the map, as the compiler says, lacks a suitable topographic base, the peculiar conditions in Nevada, with its clear air, lack of vegetation, and the general continuity of formations parallel with the north-south ranges combine to make the reconnaissance fairly satisfactory.

THE UNITED STATES.—Geologic Atlas of the United States. No. 95. Columbia Folio. Tennessee. Area, 969 square miles to an inch. Between parallels 35° 30′ and 36° and meridians 87° and 87° 30′. In the Ohio basin, and drained chiefly by the Duck River, the surface is the result of the dissection of a level or gentle undulating plain. The rocks are all of sedimentary origin, and represent deposition in portions of the Silurian, Devonian and Carboniferous periods. Mineral resources, chiefly rock phosphates and iron ore; also building stone, limestone for flux and lime and road material. Most of the soils are highly productive, and the Bigby limestone disintegrates into the best of blue grass land.

EUROPE.

AUSTRIA-HUNGARY.—Eisenbahn- und Postkarte von Oesterreich-Ungarn. Natural scale, 1:1,500,000, or 23.6 statute miles to an inch. With 6 inset maps, including Vienna, Budapest, Prague, and northwest Bohemia. Fourth Edition. Artaria & Co., Vienna, 1904. Price, 2.20 k.

Example of an excellent European railroad map, containing a large amount of information, even to the side of the tracks on which the stations are situated. An index makes it easy to find every station.

ENGLAND.—Geographical Distribution of Vegetation in the Basins of the Rivers Eden, Tees, Tyne and Wear—Part 1. Natural scale, 1:63,360, or 1 statute mile to an inch. By Francis J. Lewis, F.L.S., *The Geographical Journal*, London, March, 1904.

An excellent specimen of botanical mapping. Nineteen symbols in colours are used to show cultivation and the dominant varieties of vegetation in woodland, sub-Alpine moorland and Alpine moorland (the Pennines). Rivers and streams exceeding 15 feet in width are shown by two lines. Part I includes the southern part of the region surveyed, and Part II will embrace the northern portion.

FRANCE.—Carte de la Circonscription de la Chambre de Commerce de Boulogne-sur-Mer. No scale. The Chamber of Commerce, Boulogne, 1903.

A black-and-white map showing Boulogne and the commercial district around it on a scale so large that there is room to enumerate the characteristic industries of each town, under its name; to show the distribution of agriculture and stock-raising, and all the ways of communication from the single and double track railroad to the com-

mon roads. All the steamship connections of Boulogne are shown. The map appears, together with a plan of the port and other illustrations, in a special report of the Chamber of Commerce on the navigation, fisheries, commerce, and industries of Boulogne.

GERMANY.—De Havens van Emden en Delfzijl. Natural scale, 1:400,000. *Tijdschrift* of the Royal Netherlands Geographical Society, Vol. XXI, No. 2, 1904.

The above scale as *Tijdschrift* prints it is apparently a typographical error for 1:100,000, or 1.5 statute miles to an inch.

The scale is large enough to give a fair idea of the water improvements between the Ems River and Emden which have turned that haven into an important seaport.

RUSSIAN EMPIRE.—The Russian Empire. Natural scale, 1:8,400,000, or 132.4 statute miles to an inch. Compiled by Lieut.-Gen. Koverski. Golike & Vilborg, St. Petersburg, 1902. (Presented by Lieut.-Gen. Koverski.)

Printed in Russian, and an excellent specimen of cartography. Its information with regard to caravan and all other interior routes is fuller and more clearly expressed than on most maps of this small scale. Many desert and steppe routes in Russian Turkestan and Mongolia, with hundreds of halting places along them, are shown. The nomenclature is especially copious, and most of all along the ways of travel, whether railroad, river, common road, or caravan track. In fact, topographic delineation is almost entirely sacrificed to the purpose of showing all the routes and the places which they serve.

AFRICA.

GERMAN SOUTHWEST AFRICA.—Das Dreiecksnetz der Deutsch-Englischen Grenze-Expedition in Deutsch-Südwestafrika. Natural scale, 1:1,500,000, or 23.6 statute miles to an inch. By members of the expedition. Mitteilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten, Vol. XVII, No. 1, Berlin, 1904.

Shows the primary triangulation between 23° and 27° S. Lat., by which the position of the boundary line between German Southwest Africa and British Bechuanaland, along the 20th meridian east of Greenwich, was established, and the co-ordinates of many conspicuous topographic features and some settlements were ascertained. A large part of this boundary is now marked by iron posts.

BRITISH EAST AFRICA.—Map of Kavirondo and neighbouring country, showing racial distribution. Natural scale, 1:950,400, or 15 statute miles to an inch. Occasional Papers, No. 1. Anthropological Institute of Great Britain and Ireland. London, 1902.

Illustrating the ethnological survey of C. W. Hobley on the northeast side of Victoria Nyanza. The habitat of the four groups of natives—the Bantu and Nilotic Kavirondo and the Nandi and Masai groups, living between the lake and the highest points of the Mau plateau—are shown in colours.

EAST AFRICA.—Skizze der Ostafrikanischen Bahnen und Bahnprojekte. Scale, 1:4,000,000, or 63.1 statute miles to an inch. By H. Werther. *Koloniale-Zeitschrift*, Vol. V, No. 5. Berlin, 1904.

This is reproduced from a pen sketch, showing clearly though roughly the proposed routes of the railroads in German East Africa. These routes are: 1. The Central R.R. from Tanga, the northern port, via Korogwe and Tabora to Ujiji on Lake Tanganyika; 2. The Central R.R. from Dar es Salâm to Taboro and Ujiji (alternative project favoured by the Government); 3. The Nyasa R.R. from Kilwa, one of the southern ports, to Wiedhafen, on the northeast coast of Lake Nyasa, with an extension to Bismarckburg, near the southern end of Lake Tanganyika.

ASIA.

ASIA.—Stanford's Library Map of Asia. Natural scale, 1:6,969,600, or 110 statute miles to an inch. Edward Stanford. London, 1903.

The new edition of Stanford's map of Asia, in 4 sheets. One of the most important changes on it is the rectification of the eastern boundary of Burma in accordance with recent agreements, by which the frontier is extended to the Yünnan province of China; and is further changed in relation to the western frontiers of Siam and Indo-China. Nine scales of national linear measurements are given.

BURMA.—Britisch Birma, Nach den neuesten Grenzbestimmungen auf Grund amtlicher Quellen. Natural scale, 1:6,000,000, or 97.8 statute miles to an inch. *Petermanns Mitteilungen*, Vol. 49, No. XII. Gotha, 1903.

The map shows the extension of the British domain to the east by arrangements with Siam, China and France, so that Burma now includes the Shan States and reaches to Yünnan, extends east of the Salwen river in the lower part of its course, and its frontier along the French possessions of Indo-China has been delimited. Mixed commissions have erected boundary posts along the entire eastern frontier. The British military stations in the Shan States, and the railroads built and projected throughout Burma, are indicated.

CHINA.—OstCHINA. Natural scale, 1:1,000,000, or 15.7 statute miles to an inch. Twelve sheets. Royal Prussian Land Survey. Berlin, 1902–1904. Price, 1.5 marks a sheet.

The map, in process of production for two years, is one of the fullest and most accurate maps of the eastern part of the Chinese Empire. It extends, in the west, to the plains of eastern Sechwan. Considerable contributions to parts of the map were made by sheets, still unpublished, of Richthofen's Atlas von China. Only the German routes among the projected railroads are shown, as adequate material was found only for them.

CHINA.—Sketch Map of the Upper Yang-tse Region. Natural scale, 1:5,000,000, or 78.89 statute miles to an inch. By Lieut.-Col. C. C. Manifold. *The Geographical Journal*, London, March, 1904.

The map distinguishes between western Sechwan (mountainous) and eastern Sechwan (the Red Basin), the latter very densely populated and thoroughly cultivated; also indicates the navigable stretches of the Yangtse in the region of gorges and rapids above Ichang, the head of navigation for large vessels, to Ping-shan-hsien, above which point the river is not navigable for any kind of craft. An inset shows the routes of Lieut.-Col. Manifold from Bhamo, Burma, to Peking.

CHINA AND KOREA.—Coasts of China and Korea, including the Gulfs of Pechili and Liaotung and the northern part of the Yellow Sea. Chart 1303. Hydrographic Office, Washington, D. C., 1904.

This chart is marked "Corrected to April 1, 1904." The words "Reported to be entirely incorrect" are printed along the northeastern side of Korea Bay. They might well have been extended further west, to the lower Yalu River. The town of Wiju is shown clear to the north of the widening of the river, in a position which it has not occupied on the best maps since the publication of the map of Korea in *Petermanns Mitteilungen* (1883).

EAST ASIA.—Politisch-Militärische Karte von Ost-Asien. Natural scale, 1:7,500,000, or 118.35 statute miles to an inch. By Paul Langhans. Justus Perthes, Gotha, 1904.

A map of Japan, Korea, and Eastern China, with particular reference to the

present war. Treaty and naval ports, fortified towns, and Christian Mission Stations(!) are indicated. The broad features of topography and the means of inland and sea communication are quite clearly shown, but the scale is too small to give all the place-names of importance. Masanpho is incorrectly shown as a Russian naval station. The value of the map is much enhanced by inset maps showing the most important ports and strategic points on a much larger scale.

EAST INDIES.—Tiefen des östlichen Teiles des Hinterindischen Archipels Natural scale, 1:9,000,000, or 142.4 statute miles to an inch. After G. F. Tydeman 1902. *Annalen der Hydrographie, &c.* No. III, 1904, Berlin.

The results of the soundings of the Siboga Expedition in the part of the East Indies Archipelago, between Borneo and New Guinea, are generalized on this small map, depths from 200 to over 6,000 metres being indicated. The map illustrates a paper on the work of this Dutch expedition.

JAPAN.—General Railway Map of Japan. Scale, 13.3 miles to an inch. 1902. Presented by the Department of Communications, Tokyo.

A map, with English and Japanese nomenclature, on so large a scale that the country cross roads, as well as the main trunk roads, are shown. The Government railroads are distinguished from those in private hands, and the single and double track lines are denoted. Elevations above sea-level are given in English feet. Large insets show the railroads of Formosa and the cities of Tokio, Kioto, and Osaka, with their environs.

TIBET.—Plan of Lhasa. Natural scale, 1:16,000, or 1 statute mile to 3.96 inches. Compiled from native information by Lieut.-Col. L. A. Waddell. *The Geographical Journal*, London, March, 1904.

A black-and-white map, showing in considerable detail, and, as the compiler believes, with fair accuracy, the leading landmarks of this forbidden city. Ninety different features are indicated from the palace of the Grand Lama and other palaces, public buildings and monasteries and important residences, to the shops and markets, Chinese theatre, cemeteries, the walled dancing ground, racecourse, tilled areas and pastures, roads, and bridges. An inset, showing the environs of Lhasa, is based on the map of A. K., the Indian surveyor, but shows more detail. This interesting product was evidently a work of great labour.

POLAR.

BARENTS SEA.—Hydrologische Karte des Barents-Meeres. Scale, 1:6,000,000, or 97.8 statute miles to an inch. By Dr. L. Breitfuss. *Petermanns Mitteilungen*, No. II, 1904. Justus Perthes, Gotha.

Dr. Breitfuss's map is based upon the Russian hydrographic work in 1902, and earlier, between Novaya Zemlia and Spitzbergen, to the north of the Russian coast. The map, with the accompanying profiles, illustrates important additions to our knowledge of these waters in respect to depths, distribution of temperature, salinity, currents, and other phenomena. These researches will receive more extended notice in a later number of the BULLETIN.

ACCESSIONS TO THE LIBRARY.

JANUARY–MARCH, 1904.

AFRICA.

BURTON, A. R. E.—Cape Colony for the Settler. Issued by order of the Government of Cape Colony. (Plates, and 8 maps.) London, P. S. King & Son, 1903. 8vo.

DUFF, H. L.—Nyasaland under the Foreign Office. Illustrations and map. London, George Bell & Sons, 1903. 8vo.

EGYPT EXPLORATION FUND. Archæological Report, 1902–1903. Edited by F. Ll. Griffith. With illustrations and maps. London, Egypt Expl. Fund (1904). 4to, pr.

EGYPT EXPLORATION FUND. The Oxyrhynchus Papyri, *Part III.* Edited, with Translations and Notes, by Bernard P. Grenfell and Arthur S. Hunt. Six Plates. London, Egypt Expl. Fund. 1903. 4to.

GALLIENI, LE COMMANDANT.—Voyage au Soudan Français (Haut-Niger et Pays de Ségou), 1879–1881. 140 Gravures, 2 Cartes, 15 Plans. Paris, Hachette et Cie., 1885. 8vo.

JACKSON, E. L.—St. Helena: The Historic Island, from its Discovery to the Present Date. Illustrated. London, Ward, Lock & Co., 1903. 8vo.

JOHNSTON, SIR HARRY.—The Nile Quest . . . New York, Frederick A. Stokes Co., 1903. 8vo. (Maps, &c.) *Story of Exploration Series.*

KNIGHT, E. F.—South Africa after the War. A Narrative of Recent Travel. Illustrated. New York, Longmans, Green & Co., 1903. 8vo.

NOBLE, FREDERIC PERRY.—The Redemption of Africa. Maps, &c. New York, Fleming H. Revell Co., 1899. 2 vols. 8vo. [*Gift, from C. C. Adams, New York.*]

PRINGLE, M. A.—Journey in East Africa towards the Mountains of the Moon. [Map.] Edinburgh, William Blackwood & Sons, 1886. 8vo.

RANSOME, STAFFORD.—The Engineer in South Africa. (Maps and Illustrations.) New York, E. P. Dutton & Co., 1903. 8vo.

VIVIAN, HERBERT.—Abyssinia. With maps, &c. London, C. Arthur Pearson, 1901. 8vo.

WAHL, MAURICE.—L'Algérie. 4e Édition, mise à jour par Augustin Bernard. Paris, Félix Alcan. 1903. 8vo.

AMERICA.

ALASKA BOUNDARY, Correspondence respecting the. [British Blue Book: *United States. No. 1. 1904.*] With accompanying Map of Southeastern Alaska and Part of British Columbia. *Scale:* 1:960,000. *Size:* 18½ x 35½ inches. Printed in colour. [British Blue Book: *United States. No. 2. 1904.*] London, H. M. Stationery Office, [1904.] pr., folio.

ARIAS, CHAVERO, RIVA PALACIO, VICENTE, *et al.*—México á Través de Los Siglos. Tomos 1–5. México, Ballescá y Cia, s. a. 4to. [Illustrated.]

AZARA, FELIX DE.—Memorias sobre el estado rural del Rio de la Plata en 1801, &c., &c. Madrid, Imp. de Sanchiz, 1847. 8vo. [Portrait.]

BALCH, THOMAS.—The French in America . . . 1777–1783. Translation by E. S. and E. W. Balch of Les Français en Amérique . . . par Thomas Balch. Vol. II. Philadelphia, Porter & Coates, 1895. 8vo. [*Gift, from Edwin Swift Balch, Philadelphia.*]

BALCH, THOMAS WILLING.—The Alabama Arbitration. Philadelphia, Allen, Lane & Scott, 1900. 8vo. [*Gift, from Edwin Swift Balch, Philadelphia.*]

BONELLI, L. HUGH DE.—Travels in Bolivia; with a Tour Across the Pampas, &c. London, Hurst & Blackett, 1854. 2 vols. 8vo.

CHITTENDEN, HIRAM MARTIN.—The Yellowstone National Park. Maps, Views, &c. 4th Edition. Cincinnati, The Robert Clarke Co., 1903. 8vo.

(DISTURNELL, J.)—Description of the Cities, Townships and Principal Villages and Settlements within Thirty Miles of the City of New York. New York, Colton & Disturnell, 1839. (With map.) 16mo.

(DISTURNELL, J.)—New York as It Is, in 1835, &c. With maps . . ., also the Hudson River Guide. New York, J. Disturnell, 1835. 18mo.

DRAKE, SAMUEL ADAMS.—The Pine-Tree Coast. [Maine.] (Map and Illustrations.) Boston, Estes & Lauriat, 1891. 8vo.

(EATON, AMOS.)—Geological and Agricultural Survey of the District adjoining the Erie Canal, in the State of New York. Part I [all published]. Containing a Description of the Rock Formations; with a Geological Profile. Albany, Packard & Van Benthuysen, 1824. 8vo.

FERREIRA, FRANCISCO IGNACIO.—Diccionario Geographico das Minas do Brazil. Rio de Janeiro, Imprensa Nacional, 1885. 8vo.

GILBERT, GROVE KARL.—Alaska: Glaciers and Glaciation. *Harriman Alaska Expedition, Vol. III.* (Maps, Plates, &c.) New York, Doubleday, Page & Co., 1904. 8vo.

GRANADA, DANIEL.—Vocabulario Rioplatense Razonado. Montevideo, Becchi y Ca., 1889. 16mo.

HÖTZSCH, OTTO.—Die Vereinigten Staaten von Nordamerika. 111 Abbild., 1 farbige Karte. *Monographien zur Weltgeschichte, XX.* Bielefeld u. Leipzig, Velhagen & Klasing, 1904. 8vo.

HULBERT, ARCHER BUTLER.—Historic Highways of America. Vol. 8: Military Roads of the Mississippi Basin; Vol. 10: The Cumberland Road. Cleveland, A. H. Clark Co., 1904. 8vo. (Maps, &c.)

JAMAICA, Handbook for 1903. Comprising Historical, Statistical, and General Information. Compiled by Jos. C. Ford and A. A. C. Finlay (of the Jamaica Civil Service). London, Edw. Stanford; Jamaica, Gov't Print, Kingston, 1903. 8vo. [*Gift, from J. Lawrence Roxburgh, Assistant Colonial Secretary, Kingston, Jamaica.*]

JOHNSON, WILLIAM HENRY.—Pioneer Spaniards in North America. Illustrations. Boston, Little, Brown & Co., 1903. 8vo.

LEVASSEUR, A.—Lafayette en Amérique en 1824 et 1825, ou Journal d'un Voyage aux États-Unis. 12 gravures et carte. Paris, Librairie Baudouin, 1829. 2 vols. 8vo.

LUMSDEN, JAMES.—Through Canada in Harvest Time. Map and Illustrations. London, T. Fisher Unwin, 1903. 8vo.

NEW ORLEANS AND ENVIRONS, Norman's. With . . . Plan of the City, illustrations, &c. New Orleans, B. M. Norman, 1845. 12mo.

PETROCOKINO, A.—Along the Andes. [2 maps and illustrations.] London, Gay & Bird, 1903. 8vo.

RAIMONDY, ANTONIO.—Apuntes sobre la Provincia Litoral de Loreto. Lima, Tip. Nacional, 1862. 8vo. [2 maps.]

STEPHENS, JOHN LLOYD.—Incidents of Travel in Central America, Chiapas, and Yucatan. Revised by Frederick Catherwood. [Illustrations.] London, A. Hall, Virtue & Co., 1854. 8vo.

VILLIERS DU TERRAGE, BARON MARC DE.—Les Dernières Années de la Louisiane Française. 64 illustrations, 4 cartes. Paris, E. Guilmoto (1904). 8vo.

[WALKER, ——.] Colombia: Being a Geographical, Statistical, &c., Account of that country. London, Baldwin, Craddock & Joy, 1822. 2 vols. 8vo. [Map and 2 Portraits.]

ASIA.

ANDERSON, JOHN.—English Intercourse with Siam in the Seventeenth Century. With map. London, Kegan Paul, Trench, Trübner & Co., 1890. 8vo.

ATKINSON, G. M.—Notes on the Nicobar Islanders. [Extract: pp. 137–140, Journal Ethnological Society of London, Vol. II, 1867? No title-page. *Plate.*] 8vo.

BARTHÉLEMY, MARQUIS DE.—Au Pays Moï. 17 gravures et 2 cartes. Paris, Plon-Nourrit et Cie, 1904. 16mo.

BRADLEY-BIRT, F. B.—Chota Nagpore: A Little-known Province of the Empire. Map, &c. London, Smith, Elder & Co., 1903. 8vo.

CLEMENT, ERNEST W.—Handbook of Modern Japan. With Maps and Illustrations. Chicago, A. C. McClurg & Co., 1903. 16mo.

HAMILTON, ANGUS.—Korea. With map, &c. New York, Charles Scribner's Sons, 1904. 8vo.

HEARN, LAFCADIO.—In Ghostly Japan. (Illustrated.) Boston, Little, Brown & Co., 1899. 16mo.

MACGEORGE, G. W.—Ways and Works in India: Being an Account of Public Works in that Country, &c. Illustrations and 5 maps. Westminster, A. Constable & Co., 1894. 8vo.

PHILIPPINE ISLANDS, 1493–1898.—Explorations by Early Navigators, &c., as related in contemporaneous Books and MSS. Translated from the Originals. Edited, etc., by Emma Helen Blair and James Alexander Robertson. Vols. IX, X, and XI. Cleveland, A. H. Clark Co. 1904. 8vo. (Illustrated.)

TIBET, Papers relating to. [British Blue Book, *East India* (*Tibet*). With sketch map showing routes between Tibet and India.] London, H. M. Stationery Office, 1904. pr. folio.

VANDERLIP, W. B., AND HULBERT, H. B.—In Search of a Siberian Klondike. Illustrated. New York, The Century Co., 1903. 8vo.

WILLSON, BECKLES.—Ledger and Sword: or the Honourable Company of Merchants of England trading to the East Indies (1599–1874). Illustrations and map. London, Longmans, Green & Co., 1903. 2 vols. 8vo.

AUSTRALASIA.

EDEN, WILLIAM.—History of New Holland, from Its First Discovery in 1616 to the Present Time, &c. London, John Stockdale, 1787. 8vo. [2 folding maps.]

GIBBS, PHILIP H.—Australasia: The Britains of the South. 4 coloured plates, &c. London, Cassell & Co., 1903. 16mo.

HERBERTSON, A. J., AND HERBERTSON, F. D.—Australia and Oceania. *Vol. V. Descriptive Geography from Original Sources.* Illustrations. London, A. & C. Black, 1903. 16mo.

NEWLAND, SIMPSON.—Land-Grant Railway across Central Australia. With Illustrations, Maps, &c. Adelaide, Hussey & Gillingham, *for the Government*, 1902. Folio. [*Gift, from Simpson Newland, Adelaide, S. A.*]

BIOGRAPHY.

BALCH, THOMAS WILLING.—Émeric Crucé. Philadelphia, Allen, Lane & Scott, 1900. 8vo. [*Gift, from Edwin Swift Balch, Philadelphia.*]

COURANT, MAURICE.—Ôkoubo. [Ministre japonais.] Paris, Félix Alcan, 1904. 8vo. *Ministres et Hommes d'Etat.*

SKRINE, FRANCIS HENRY.—Life of Sir William Wilson Hunter. (Illustrations.) London, Longmans, Green & Co., 1901. 8vo.

BOTANY.

DURAND, T., AND JACKSON, B. D.—Index Kewensis, Supplementum Primum, Fasc. III. Bruxellis, A. Castaigne. s. a. 4to.

PORCHER, FRANCIS PEYRE.—Resources of the Southern Fields and Forests, &c. Revised Edition. Charleston, Walker, Evans & Cogswell, 1869. 8vo.

DISCOVERY.

CORTÉS, HERNANDO.—Carta . . . que escrivio a la S. C. C. M. el Emperador, &c., &c. Año de 1524. En México, J. G. Icazbalceta, 1865. sm. 4to.

FISCHER, JOSEPH.—The Discoveries of the Norsemen in America, with special relation to their early Cartographical Representation. Translated from the German by Basil H. Soulsby. (11 Plates.) St. Louis, Mo., B. Herder, 1903. 8vo.

FISCHER, JOS., AND WIESER, FR. R. v.—Die Älteste Karte mit dem Namen Amerika aus dem Jahre 1507 und die Carta Marina aus dem Jahre 1516, des M. Waldseemüller (Ilacomilus.) Innsbruck, Wagner, Univ. Buchh., 1903. Folio. [26 double-page plates, 10 illustrations in the Text.]

HAKLUYT, RICHARD.—Principal Navigations, Voyages, Traffiques and Discoveries of the English Nation. [New Edition.] (Illustrations.) *Extra Series Hakluyt Society.* Vols. III–IV. Glasgow, James MacLehose & Sons, 1903–1904. 8vo.

STEVENSON, EDWARD LUTHER.—Maps illustrating Early Discovery and Exploration in America, 1502–1530, reproduced by Photography from the Original MSS. *No. 2:* Munich–Portuguese, 1502–4, 6 sheets; *No. 3:* Pilestrina, 1503–5, 4 sheets; *No. 9:* Weimar–Spanish, 1527, 12 sheets; *No. 11:* Ribero, 1529, 12 sheets; *No. 12:* Verrazano, 1529, 24 sheets. New Brunswick, N. J., E. L. Stevenson, 1903. *Portfolios.*

THACHER, JOHN BOYD.—Christopher Columbus. *Vol. III.* (Maps, Plates, &c.) New York, G. P. Putnam's Sons, 1904. R. 8vo.

TWISS, TRAVERS.—Christopher Columbus: A Monograph on his True Burial Place. London, Trübner & Co., 1879. pr., 8vo.

VIGNAUD, HENRY.—Critical Study of the Various Dates assigned to the Birth of Christopher Columbus. The Real Date, 1451. *With Bibliography.* London, Henry Stevens, Son & Stiles, 1903. 8vo. [*Gift, from the Author.*]

EUROPE.

ALPS, EASTERN. Handbook for Travellers. 53 maps, 10 plans and 7 panoramas. 10th Edition. Leipsic, Karl Baedeker, 1903. 16mo.

BESANT, WALTER.—East London. Illustrations. New York, The Century Co., 1901. 8vo.

BOULOGNE, La Chambre de Commerce et le Port de. [Maps and Charts.] Boulogne-sur-mer, A. Baret, 1903. 4to. [*Gift, from the Chambre de Commerce, Boulogne-sur-mer.*]

BRAUN, GUSTAV.—Ostpreussens Seen. Geographische Studien. Inaugural-Dissertation ... Albertus-Universitat zu Königsberg, 1 Juli 1903. Königsberg, R. Leupold, 1903. 4to. [2 maps.] [*Gift, from the Author.*]

[BREMEN.] Die Volkszählung vom 1. Dezember 1900 im Bremischen Staate. 1. Band, Einleitung. 1. Teil (Bevölkerungsstatistik) Herausgegeben vom Bremischen Statistischen Amt. Bremen, G. A. von Halem, 1903. 8vo. [*Gift, from the Bremisches Statistisches Amt.*]

FARJON, M. F.—Voies d'accès au Simplon. Rapport fait à la Chambre de Commerce. Boulogne-sur-mer, A. Baret, 1902. 8vo. pr. [*Gift, from the Chambre de Commerce, Boulogne-sur-mer.*]

FLOUR DE SAINT-GENIS.—La Propriété Rurale en France. (Cartes.) Paris, Armand Colin, 1902. 8vo.

FREEMAN, E. A.—Historical Geography of Europe. [*With Atlas.*] Third Edition, Edited by J. B. Bury, M.A., &c. London, Longmans, Green & Co., 1903. 2 vols. 8vo.

FROSTERUS, BENJ.—Bergbyggnaden i Sydöstra Finland. [With map, &c.] Helsingfors, 1902. 8vo. [*Gift, from the Author.*]

FROSTERUS, BENJ.—Hufoudtyper inom de sydfinska landskapsformerna och berggrundens betydelse för uppkomsten af den. *Fennia, Vol. 18, 9.* Helsingfors, 1901. 8vo. [*Gift, from the Author.*]

GEORGE, H. B. (*Editor*).—The Alpine Journal. By Members of the Alpine Club. (Maps, &c.) Vol. I, 1863–64; Vol. II, 1865–66. London, Longmans, Green & Co., 1864–66. 8vo.

GEORGE, H. B.—The Oberland and Its Glaciers. 28 Photographic Illustrations and a Map. London, Alfred W. Bennett, 1866. 4to.

GRIBBLE, FRANCIS.—Lake Geneva and Its Literary Landmarks. (With Illustrations.) Westminster, A. Constable & Co., 1901. 8vo.

GUI, PIO.—Il Fiume Sacco ed i Suoi Affluenti. [With Map.] Roma, Tip, Forzani e C., 1901. 8vo. [*Gift, from the Author.*]

HAAS, HIPPOLYT.—Neapel, seine Umgebung und Sizilien. 154 Abbild., 1 farbige Karte. *Land und Leute: Monographien zur Erdkunde, XVII.* Bielefeld und Leipzig, Velhagen & Klasing, 1904. 8vo.

HAUSHOFER, MAX.—Tirol und Vorarlberg. 202 Abbild., 1 farbige Karte. *Land und Leute: Monographien zur Erdkunde, IV.* Bielefeld u. Leipzig, Velhagen & Klasing, 1903. 8vo.

ISRAELS, JOZEF.—Spain: The Story of a Journey. Translated from the Dutch by Alexander Teixeira de Mattos. Portrait and 39 Reproductions of Drawings by the Author. London, John C. Nimmo, 1900. 4to.

ITALY, Handbook for Travellers. By K. Baedeker. *2nd Part*: Central Italy and Rome. 14 maps, 49 plans, panorama, etc. 14th Revised Edition. Leipzig, Karl Baedeker, 1904. 16mo.

KENNEDY, E. B.—Thirty Seasons in Scandinavia. (Illustrations.) London, Edward Arnold, 1903. 8vo.

KUPCZANKO, GREGOR IW.—Russland in Zahlen. Statistisches Sammelwerk. Eisenbahnkarte. Leipzig, Verlag von Otto Wigand, 1902. 8vo.

LAIR, MAURICE.—L'Impérialisme allemand. Paris, Armand Colin, 1902. 8vo.

LUND, T. W. M.—Como and Italian Lake-Land. (Illustrations.) London, W. H. Allen & Co. 1887. 8vo.

NORTH DEVON [including West Somerset] AND NORTH CORNWALL, &c., by C. S. Ward. *Thorough Guide Series, III.* 21 maps and plans. 8th Edition, revised. London, Dulau & Co., 1903.

NORWAY, SWEDEN AND DENMARK, Handbook for Travellers. 37 maps, 22 plans and 3 panoramas. 8th Edition. Leipsic, Karl Baedeker, 1903. 16mo.

[PHIBBS, ISABELLA MARY.] The Grand Duchy of Finland. [With map.] London, T. Fisher Unwin, 1903. 16mo.

SKRINE, FRANCIS HENRY.—The Expansion of Russia, 1815–1900. [3 maps.] Cambridge, The University Press, 1903. 8vo.

WOODLEY, GEORGE.—View of the Present State of the Scilly Islands: &c., &c. With chart. London, F. C. & J. Rivington, *et al.*, 1822. 8vo.

GEOGRAPHY.

CHISHOLM, GEO. G.—Handbook of Commercial Geography. 4th Edition. London, Longmans, Green & Co., 1903. 8vo. [27 maps.]

DUBOIS, MARCEL & KERGOMARD, J. G.—Précis de Géographie Économique. 2e Ed., revue, &c. avec la collaboration de M. Louis Lafitte. Paris, Masson et Cie., 1903. 8vo.

HERBERTSON, A. J.—Commercial Geography of the World, outside the British Isles. [Map.] London, W. & R. Chambers, 1903. 16mo.

MALTE-BRUN.—System of Universal Geography . . . Additions and Corrections by James G. Percival. Boston, Samuel Walker, 1834. 3 vols. 4to. Maps and Engravings. [*Gift, from Mrs. S. B. Clarke, New York.*]

RÉVY, J. J.—Hydraulics of Great Rivers: The Paraná, the Uruguay and the La Plata Estuary. London, E. & F. N. Spon, 1874. 4to. [8 Plates: one a map.]

TARR, R. S.—New Physical Geography. (Illustrations.) New York, The Macmillan Co., 1904. 16mo.

GEOLOGY.

CHAMBERLIN, T. C., AND SALISBURY, R. D.—Geology. Vol. I: Geologic Processes and their Results. Plates, &c. *American Science Series, Advanced Course.* New York, Henry Holt & Co., 1904. 8vo.

HOLMES, FRANCIS S.—Phosphate Rocks of South Carolina and the "Great Carolina Marl Bed." Illustrations. Charleston, Holmes' Book House, 1870. 8vo.

HOLMES, FRANCIS S.—Post-Pleiocene Fossils of South Carolina. (Plates.) Charleston, Russell & Jones, 1860. 4to.

LE CONTE, JOSEPH.—Elements of Geology. Revised and partly rewritten by Herman Le Roy Fairchild. 5th Edition, with new Plates, &c. New York, D. Appleton & Co., 1903. 8vo.

TUOMEY, M.—Report on the Geology of South Carolina. (Maps, &c.) Columbia, A. S. Johnston, 1848. 4to.

HISTORY.

DURUY, VICTOR.—History of Greece and of the Greek People. Translated and Edited by M. M. Ripley. (Engravings, Maps, &c.) Boston, Estes & Lauriat, 1890–1891. 4 vols. in 8. R. 8vo.

DURUY, VICTOR.—History of Rome and of the Roman People. Translated by M. M. Ripley and W. J. Clarke. Edited by J. P. Mahaffy. (Engravings, Maps, &c.) Boston, Dana Estes & C. E. Lauriat, 1884–1887. 8 vols. in 16. R. 8vo.

[JOVIUS, PAULUS.]—*La Prima Parte* dell' Istorie del suo Tempo di Mons. Paolo Giovio.....Tradotta per M. Lodovico Domenichi.....(Firenze), [Torrentino] 1555; *Seconda Parte*.....Vinegia, Altobello Salicato, 1572. 2 vols. 4to.

RAMSAY, DAVID.—History of the Revolution of South Carolina from a British Province to an Independent State. [5 Maps.] Trenton, Isaac Collins, 1785. 2 vols. 8vo.

MAPS.

[AFRICA.] Jenné et Temboctou, Carte Générale du Voyage fait par Mr. Caillié. Rédigée par Mr. Jomard. *Scale:* 1:8,000,000. [Avec Carte Itinéraire du même Voyage. *Scale:* 1:1,000,000.] Paris, Jomard, 1829. *Size:* 34 x 23 inches. Engraved on copper.

AMSTERDAM, City of. [References in Dutch and French.] Te Amsterdam, Gebroeders Van Cleef, 1883. *Scale:* 7¾ inches = 1 mile. *Size:* 20x14½ inches. Printed on muslin. [*Gift, from William Poillon, New York.*]

ASIA.—Politisch-militärische Karte von Ost-Asien. Paul Langhans. Sheet, 26½ x 21½ inches, containing 17 maps, various scales. Gotha, Justus Perthes. 1900.

[AUSTRIA-HUNGARY.] Artaria's Eisenbahn u. Postkarte von Oesterreich-Ungarn. 4te Auflage. *Scale:* 24 miles = 1 inch. [5 Insets, various scales.] Wien, Artaria & Comp., 1904. *Size:* 43¾x30¼ inches. Printed in colours.

BALKAN PENINSULA. Bathymetrical Survey of the Lakes. 10 maps, various scales. Printed in colour. Servian text.] Belgrade, Academy of Sciences, 1902. [*Gift, from the Academy of Sciences.*]

BRITISH COLUMBIA, Province of. Compiled by direction of the Hon. W. C. Wells, Chief Commissioner of Lands and Works, Victoria, B. C., Dep't of Lands & Works, 1903. *Scale:* 20 miles = 1 inch. *Size:* [2 sheets joined] 52 x 43½ inches. [*Gift, from the Deputy Commissioner of Lands and Works, Victoria, B. C.*]

CANADA, Partie Orientale du. Traduite de l'Anglois de la Carte de Jefferys en May 1755 par Le Rouge. Paris, Le Rouge [1755?] *Scale:* 31 miles = 1 inch. *Size:* 23 x 17¼ inches. Engraved on copper.

CHINA, Karte von Ost, 12 Sheets: Yü-lin fu; Peking; Mukden; Hsi ngan fu; Tsi nan fu; Tsingtau; Yi-tschang-fu; Hankau; Nanking; Nan tschang fu; Futschau; Amoy [and Key map.] Berlin, Kartogr. Abtheilung der K. Preuss. Landes-Aufnahme, 1904. *Scale:* 16 miles = 1 inch. *Size*, each sheet, 24¼ x 17½ inches. Lithographed in colours.

GUADELOUPE, La. Par Le Rouge. [Inset, Isle de Bourbon.] Paris, Le Rouge, 1753. *Scale:* 1⅓ lieue = 1 inch. *Size:* 20¼ x 17⅝ inches. Engraved on copper, coloured by hand.

ISLAND OF ISLAY, as surveyed by Stephen McDougall, Land-surveyor, in 1749–

50 and 51. Glasgow, Maclure, Macdonald & Co., 1848. *Scale,* of chains, 100 to 1 inch, each 74 feet. *Size:* 16½ x 20⅝ inches. [*Gift, from McDougall Hawkes, New York.*]

JAPAN, General Railway Map of. 1902. [With Formosa.] *Scale:* 14 miles = 1 inch. Insets of Tokio, Kioto and Osaka, Kokura and Hakata: 6 miles = 1 inch. References in Japanese and English. *Size:* 95 x 32½ inches. [*Gift, from the Department of Communications of Japan, Tokyo.*]

KOREAN ARCHIPELAGO, Southern Portion. London, Admiralty Chart No. 104, revised to 1904. *Scale:* 6 nautical miles = 1 inch. *Size:* 38½ x 24⅝ inches.

KWANG TUNG PENINSULA, including Ta Lien Hwan and the Approaches to Port Arthur. *Scale:* ¾ inch = 1 nautical mile. [Inset, Odin Cove. *Scale:* 5½ inches = 1 nautical mile.] London, Admiralty Chart No. 1798; revised to 1903. *Size:* 38¼ x 25 inches.

MADAGASCAR, Carte Administrative de. (Divisée en ses Cercles.) Bureau Topographique de l'Etat Major, 1901. *Scale:* 40 miles=1 inch. *Size:* 17⅛ x 25¾ inches. Coloured. [*Gift, from the Government of Madagascar.*]

MADAGASCAR, Carte de. Publiée par le Service Géographique du Corps d'Occupation, Juillet, 1900. *Scale:* 6 miles = 1 inch. *Size:* 6 sheets [if joined], 35⅜ x 46¼ inches. Printed in colours. Accompanied by "Carte des Etapes," without physical features. [*Gift, from the Government of Madagascar.*]

[MADAGASCAR, Map of.] Service Géographique du Corps d'Occupation, 1898-1900. *Scale:* 8 miles = 1 inch. 26 sheets, of various sizes, printed in colours. [*Gift, from the Government of Madagascar.*]

MARTINIQUE, LA. Une des Antilles Françoises de l'Amérique. Dressée . . . par Le Rouge. Paris, Le Rouge, 1753. *Scale:* 1 lieue = 1 inch. *Size:* 23¾ x 18⅝ inches. Engraved on copper.

[NEVA ENTRANCE], Kronstadt bis St. Petersburg. Berlin, Reichs-Marine Amt. *Sheet No. 154,* 1902. *Scale:* 1½ inches = 1 nautical mile. *Size:* 40 x 25½ inches. Engraved on copper. [*Gift, from the Reichs-Marine-Amt, Berlin.*]

[NORTH AMERICA.] Nord Amerika aus Sohr-Berghaus Hand-Atlas. Von Prof. Dr. A. Bludau und Otto Herkt [with 11 insets]. Glogau, Carl Flemming [1904]. *Scale:* 160 miles = 1 inch. *Size:* 26½ x 33 inches. Lithographed in colours. [*Gift, from Lemcke & Buechner, New York.*]

NORTH ATLANTIC OCEAN, Part of. [From C. Chouard to Watling Island. French map: "Sur la Navigation de Terre-Neuve à New York."] Paris, Le Rouge [1756?] *Scale:* about 180 nautical miles = 1 inch. *Size:* 14⅛ x 12½ inches. Engraved on copper.

NOVA SCOTIA, Church's Mineral Map of. Revised edition, showing . . . coal, gold . . . and Ore beds . . . 1889. Bedford, Halifax Co., A. F. Church [1901?]. *Scale:* 12 miles = 1 inch. *Size:* 29 x 23 inches. [*Gift, from the Commissioner Public Works and Mines, Halifax, N. S.*]

NOVA SCOTIA. Geological Sheets Nos. 42 to 46; 56 to 58. *Reference, Part P., Annual Report Geological Survey of Canada, Vol. V, 1890–91.* Ottawa, 1901–1903. *Scale:* 1 mile = 1 inch. *Size:* 18¼ x 12⅜ inches. [*Gift, Geological Survey Department of Canada, Ottawa.*]

NOVA SCOTIA. Province of. Including the Island of Cape Breton. Mackinlay's map. Halifax, N. S., A. & W. Mackinlay, 1862. *Scale:* 9 miles = 1 inch. *Size:* 37⅜ x 29¼ inches. Coloured. Mounted on muslin, dissected to fold in 8vo cover.

PE CHILI AND LIAU TUNG, Gulfs of. *Scale:* 11½ nautical miles = 1 inch. [5 Insets: Hope Sound; Chifu Is. Anchorage; Thornton Haven; Entrance to Li-Tsin-Ho; Entrance to Ta-san-Ho. Various scales.] London, Admiralty Chart No. 1256. Revised to 1903. *Size:* 40⅝ x 24¼ inches.

PORT ARTHUR OR LU SHUN KAU, Approaches to. *Scale:* 4 inches = 1 nautical mile. [Inset of Port Arthur: *Scale:* about 9 inches = 1 mile.] London, Admiralty Chart No. 1236. Revised to 1903. *Size:* 19 x 25½ inches.

RIO DE JANEIRO, Planta da Cidade do., e de uma parte dos suberbios. Originada e desenhada pelo Major E. de Maschek. Rio de Janeiro, Laemmert & Cia. [1903?]. *Scale:* 6⅓ inches=1 mile. *Size:* 40 x 31¾ inches. Lithographed in colour, mounted on muslin, dissected, and folded in 8vo cover.

RUSSIAN EMPIRE, Map in the Russian character, with 10 photo-engraved pictures and descriptive text in the margins. *Scale:* 120 miles = 1 inch. *Size:* 46½ x 30¾ inches. Lithographed in colours, muslin, dissected and folded in portfolio. Accompanied by 42 pp. text and Statistical map of Asia in 8vo form. St. Petersburg, Golike & Vilborg, 1902. [*Gift, from Lieut. Gen. Koverski, St. Petersburg.*]

UNITED STATES. By David H. Vance. *Scale:* 35 miles = 1 inch. [Inset: North America: *Scale:* 255 miles = 1 inch.] Philadelphia, Anthony Finley, 1825. Engraved by J. H. Young. Coloured by hand. *Size:* 59½ x 49¾ inches. Muslin, dissected to fold.

PHYSIOGRAPHY.

BERGET, ALPHONSE.—Physique du Globe et Météorologie. [14 Planches.] Paris, C. Naud, 1904. 8vo.

GIRARD, JULES.—L'Evolution comparée des Sables. (Planches.) Paris, F. R. de Rudeval, 1903. 8vo. [*Gift, from the Author.*]

VARIOUS.

ALMANACH DE GOTHA, 1904. Annuaire Généalogique, Diplomatique et Statistique. Gotha, Justus Perthes, 1904. 16mo.

ALMANACK, WHITAKER'S, 1904. London, J. Whitaker. 8vo.

AMERICAN NUMISMATIC AND ARCHÆOLOGICAL SOCIETY: Report of the Committee on Medals, January 18, 1904. New York, Bradstreet Press, 1904. pr. 4to. [*Gift, from Edward D. Adams, New York.*]

BALCH, THOMAS.—International Courts of Arbitration, 1874. [Reprinted, etc., by T. W. Balch.] Philadelphia, H. T. Coates & Co., 1899. 8vo. [*Gift, from Edwin Swift Balch, Philadelphia.*]

DICCIONARIO DE LA LENGUA CASTELLANA por la Academia Española. Septima Edicion. Paris, Bossange Père, 1824. 2 vols. 4to.

ENCYCLOPÆDIA, JEWISH.—Vol. VI. New York and London, Funk & Wagnalls, 1904. 8vo.

[ENCYCLOPÆDIA] MEYERS Grosses Konversations-Lexikon (6te Auflage). Band V. Leipzig u. Wien, Bibliographisches Institut, 1903. 8vo.

FLETCHER, W. I., AND BOWKER, R. R.—The Annual Literary Index, 1903. New York, Publishers' Weekly, 1904. 8vo.

HAGGARD, H. RIDER.—Winter Pilgrimage . . . through Palestine, Italy, and the Island of Cyprus. (Illustrations.) London, Longmans, Green & Co., 1901. 8vo.

HASKINS, CHARLES WALDO.—Business Education and Accountancy. Edited by F. A. Cleveland. [Portrait.] New York and London, Harper & Brothers, 1904. 8vo. [*Gift, from E. W. Sells, New York.*]

JARDINE, SIR W., *Editor.*—The Naturalist's Library: Mammalia, 13 vols.; Birds, 14 vols.; Fishes, 6 vols.; Insects, 7 vols. (Coloured Plates.) Edinburgh, W. H. Lizars, 1843. 40 vols. 12mo.

LAY, WILLIAM AND HUSSEY, CYRUS M.—Narrative of the Mutiny on board the Ship Globe . . . Jan., 1824, &c. New London, 1828. (Reprint by The Abbey Press, New York [1903].) 12mo.

MARINE SOCIETY of the City of New York. Memoir, read at the Annual Dinner, Jan. 7th, 1877, together with the Supplement of Dec. 1, 1903, by Captain Gustavus D. S. Trask, &c., &c. With Charter and By-Laws, Officers and Members. New York, Printed for the Society, 1903. 8vo. [*Gift, from the Marine Society, New York.*]

VOYNICH, W. M.—Eighth List of Unknown and Lost Books, with Supplement. London, 10th June, 1902. 8vo. [*Gift, from S. P. Avery, New York.*]

WHO'S WHO, 1904. An Annual Biographical Dictionary. London, Adam and Charles Black, 1904. 8vo.

WILDERMANN, MAX.—Jahrbuch der Naturwissenschaften, 1902–1903. Freiburg im Breisgau, Herdersche Verlagshandlung, 1903. 8vo. 46 Abbildungen u. 2 Kärtchen.

WORLD ATLAS AND GAZETTEER, The Handy. (120 maps.) New York, Frederick Warne & Co. [1903?]. 16mo.

AMERICAN EXPLORERS IN AFRICA.

In the BULLETIN of the American Geographical Society for January, 1904, is a letter from Colonel Ch. Chaillé-Long, which should attract widespread attention. In July, 1874, Col. Chaillé-Long was the first white man to cross over a part of Lake Victoria Nyanza. In August, 1874, he canoed down an entirely unexplored portion of the White Nile, extending from about the 1st to the 2nd degree of north latitude. On this journey he discovered and crossed a wholly unknown lake, the fourth in size of the lakes of the upper Nile basin, which was named Lake Ibrahim by the Khedive Ismail. These discoveries were clearly set forth in Col. Chaillé-Long's book, *Central Africa*, New York, 1877, and they entitle Col. Chaillé-Long, together with Speke, Baker, and Stanley, to be considered as one of the four chief explorers of the White Nile.

Another American also, Paul B. Du Chaillu, made one of the greatest discoveries in Central Africa, perhaps—namely, that of the pygmies. As a rule, Dr. Schweinfurth gets most of the credit, even by such careful anthropologists as De Quatrefages in *The Pygmies*,

XUM

and by Deniker in *The Races of Man.* Dr. Schweinfurth himself is not to blame, for he mentioned Du Chaillu's priority in *The Heart of Africa*, New York, 1874. Years before Schweinfurth, however, several travellers, among whom was D'Abbadie, I think, spoke from hearsay of a dwarf race. In 1860 the Rev. Lewis Krapf published his *Travels, Researches and Missionary Labors*, in which he gave an account of a "doko" pygmy tribe he had heard of as dwelling south of Abyssinia; stated that he saw at Barava a slave who accorded completely with the description of the Doko, and on his map placed the words "Doko (Pygmies)" exactly where Dr. Donaldson Smith discovered the Dume, a "doko" tribe of dwarfs, in 1895. But it was Paul B. Du Chaillu who, in 1865, discovered the Obongo pygmies and visited one of their villages in the Gaboon region, and his account, published in *A Journey to Ashango Land*, London, 1867, is the first description from actual observation of a tribe of African pygmies.

It is high time, it seems to me, for American geographers to insist that the discoveries of our fellow-countrymen in the unknown regions of the earth should receive full and just recognition.

EDWIN SWIFT BALCH.

PHILADELPHIA, March 20, 1904.

BOOK NOTICES.

Glaciers and Glaciation, by Grove Karl Gilbert; Vol. III of the Harriman Alaska Expedition. Doubleday, Page & Co., 231 pp., with 18 plates and 106 figures in the text.

Vols. I and II, edited by C. Hart Merriam, and giving the narrative of the expedition, have already been noticed in this BULLETIN, Vol. 33, 1901, pp. 467–469. The volume before us is the first in the technical series. Mr. Gilbert does not profess to have added greatly to our knowledge of Alaskan glacial geology, but his reconnaissance of Alaska's long shore-line was comprehensive, and such a general survey by one of the most experienced of American observers could not fail of great interest. He has combined his work with the detailed studies of Reid, Russell, and others, forming the first general review of Alaskan ice work. The first part of the volume deals with existing glaciers, and the second with Pleistocene glaciation. Photographs in great numbers were taken by the author and by many members of the expedition, and in

addition to these the photographic collections of the Canadian Boundary Commission were studied. This greatly aids Mr. Gilbert in describing as precisely as possible the present condition of the glaciers, and giving trustworthy data for comparisons in future years. A folding map shows the route pursued along the interior passage from Seattle to Glacier Bay and Sitka, to Prince William Sound, Cook Inlet, Kadiak, Unalaska, and St. Matthew Island to landings on both shores of Bering Strait.

The net retreat of the Muir Glacier in nineteen years was 8,500 feet. The Johns Hopkins and Grand Pacific glaciers were once confluent with the great trunk stream in Glacier Bay, but now enter the bay independently some distance northwest of the Muir Glacier front. These glaciers retreated from three to four miles in the twenty years from 1879 to 1899. The recent history, however, does not all tell of retreat, for La Perouse Glacier, on the western or seaward base of the Fairweather Range, has invaded an ancient forest, mingling tree-trunks with bouldery till, thus covering ground on which the trees had grown unhindered for some centuries.

The great Malaspina Glacier, studied by Russell, lies at the entrance of Yakutat Bay, on the north. Far within is a retired channel, Russell Fiord, which receives Hidden Glacier from the east. The gravel plain in front of it shows pits and lakelets, which are due to melting from beneath of masses of buried ice, a process which must have been common in the departure of our great American ice sheets, but likewise a process that the glacialist cannot often see in fresh and recent manifestation. The modification of rock contours in this locality, due to glacial erosion, is characterized as profound. The glacialist will also find interest in a passage on pages 69–70 concerning the work of "ice-fall waves." On small lakes or narrow inlets the winds cannot generate waves adequate to strong shore action. Such a narrow water surrounds Osier Island, where Disenchantment Bay passes into Russell Fiord. Yet its cliffs are considerable, and the waves that have shaped them are mainly due to disturbance of the water by ice-falls occurring every few minutes along the four miles of ice-cliff at the front of the Hubbard Glacier. This may help to explain shore phenomena, which appear in seemingly impossible situations in areas of ancient glaciation.

A summary of modern glacial changes is given (pp. 102–106), and the discordances in these variations afford an interesting discussion (pp. 106–112).

As might be expected, Chapter II, on Pleistocene Glaciation, is yet more prolific of suggestions which cast light on glacial problems. The "hanging valley" finds abundant illustrations along the Alaskan shores, and seems to carry to the point of demonstration the capacity of trunk glaciers to deepen their valleys to a degree quite discordant with the work of the tributary ice streams. When the ice has melted out, therefore, the drainage of the lateral valley passes by a waterfall to the more deeply-sunken channel of the main stream.

The author has no hesitation in explaining the high and much-dissected plateau of the Lynn Canal and Walker Bay regions as a lofty peneplain. The crest lines now apparent are not those to be expected from the rock structure, but are such as would arise from a base-levelling process, with subsequent elevation and some sculpturing. Parts of a low peneplain are also recognized, as near Sitka, as well as a yet lower or submerged base-level, probably belonging to a cycle younger than that of the low peneplains.

Again, Mr. Gilbert records his conviction of great glacial erosion. Speaking generally of the region, he calls the work of rounding (of summits) extensive, and affirms that "in many places the depth of rock pared away in the mere smoothing of a rough topography must have amounted to several hundred feet" (p. 140). Referring to the troughs about Vancouver Island (p. 144), he says: "I have not been able to suggest an origin that does not involve an immense amount of excavation by ice." Other topics of interest are found in the extension of ice sheets into the sea (p. 163)—glaciation in the Bering Sea region; the influence of crevasses on the form of terminal moraines; comparisons of plucking and abrasive work; the pressure of tidal glaciers; and a comparison of the behaviour of rivers and glaciers. As with the earlier volumes, the publishers have done their part in a substantial and artistic way.

A. B. P.

Ausgewählte Stücke aus den Klassikern der Geographie für den Gebrauch an Hochschulen. Selected by Dr. Prof. O. Krümmel. First Series. VII and 174 pp., and 8 illustrations. Lipsius & Tischer, Kiel and Leipzig, 1904. (*Price, 2.50 marks.*)

The same, Second Series. VIII and 174 pp., and 9 illustrations.

These books are the first of a series of extracts from the classics of geography, selected by Dr. Prof. Otto Krümmel, the distinguished oceanographer, and intended for the use of high schools.

The best geographical literature in all languages will evidently be represented. These two volumes include extracts from the German, French, and English. The contents embrace five extracts from the works of von Humboldt (3 in French), three from Carl Ritter, five from Peschel, one from Darwin, one from von Sydow, and one from von Richthofen. The selection from von Sydow is an illuminative paper on Cartography. The extract from Darwin is "The Theory of the Formation of the different Classes of Coral Reefs" from his epoch-making "The Structure and Distribution of Coral Reefs." It is to be presumed that one of the later volumes will contain an authoritative statement of the results of the recent investigations on this subject. The extract from von Richthofen is on "The Relations of China to other Parts of the World" from his great work on China. Among the topics chosen from Peschel's writings are "Colonial Projects" and "Influence of Commerce Upon the Distribution of Population." Three of the selections from von Humboldt are "The Equinoctial Current and the Gulf Stream," "The Peru Current," and "Considerations upon the Population of America." One of the topics from Carl Ritter is "The Geographical Position and Horizontal Extent of the Continents." The third volume will contain extracts from von Richthofen, Charles Lyell, Eduard Suess, August Grisebach, and J. G. Kohl.

The aim to present to advanced students of to-day selections from the best products of the great geographical writers is to be commended in the highest terms; and the publishers of these books are to be congratulated on having Dr. Krümmel's superintendence of this work and on making the books convenient in form, excellent in typography, and cheap in price.

Gletscherkunde. By Dr. Fritz Machacek. 125 pp., 16 illustrations and index. G. J. Göschen'sche Verlagshandlung. Leipzig, 1902. Price, 80 pf.

This is one of the Sammlung Göschen, a series of little books, 6 x 4¼ inches, which has now reached 150 volumes, each presenting a uniform and systematic treatment of some subject in science, art, literature, or history. Gletscherkunde maintains the high level of excellence that from the first has marked this publishing enterprise, whose essential aim is to popularize knowledge. The book is not only thoroughly scientific, but also simple in exposition, well arranged, and interesting from the first to the last pages. The topics are divided into eight sections: (I) Glaciers in

general; snow regions and the snow line. (II) The régime of glaciers: Their Nourishment, ablation, and glacial brooks. (III) The material of glaciers and their structure. (IV) Movement of glaciers. (V) The relations of glaciers to their immediate surroundings, as the rock walls which confine them and their bed. (VI) The geographical distribution of glaciers. (VII) The Oscillations or the advance and retreat of glaciers. (VIII) The Ice Age. Tables show the height of the snow-line in all parts of the world and the loss in area of retreating glaciers, as far as it has been ascertained.

TRANSACTIONS OF THE SOCIETY.

MARCH, 1904.

A Regular Meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, March 15, 1904, at 8.30 o'clock P.M.

Vice-President Moore in the chair.

The following persons, recommended by the Council, were elected Fellows:

Francis H. Bacon.	Oliver W. Barnes.	Robert F. Amend.
Rev. Hudson Stuck.	Edward G. Bailey.	William L. Findley.
	J. Dunbar Wright.	

The Chairman then introduced the speaker of the evening, Prof. William M. Davis, of Harvard University, who addressed the Society on A Journey in Turkestan.

Maps and views were shown on the screen.

On motion, the Society adjourned.

NOTES AND NEWS.

THE NEXT MEETING of the Society will be held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, April 19, 1904, at 8.30 o'clock P.M.

Dr. Edmund O. Hovey will address the Society on Southern Russia and the Caucasus Mountains.

EIGHTH INTERNATIONAL GEOGRAPHIC CONGRESS.—The presidency of the Congress has been accepted by Commander Robert E. Peary, U. S. N.

In response to inquiries received Fellows of this Society are informed that remittances by money order, draft or check, for membership in the Eighth International Geographic Congress should be made payable to John Joy Edson, Treasurer,

HUBBARD MEMORIAL HALL,
WASHINGTON, D. C.

THE GENERAL ASSEMBLY of the State of Maryland, by joint resolution, approved March 3, 1904, voted a gold medal to Colonel Charles Chaillé-Long, in recognition of his contribution to the solution of the Nile problem by the discovery of Lake Ibrahim in 1874 and his services to humanity rendered at the time of the bombardment of Alexandria in 1882.

MÍMIR. ICELANDIC INSTITUTIONS WITH ADDRESSES. This publication, the first issue of which has just been received, has for its objects:

1. To facilitate research in the territory which it attempts to cover;

2. To inform the people of Iceland of the interest taken in their literature and history by the learned of other nations;

3. To bring the foreign student of Old Northern letters into nearer relation with Iceland and its living speech;

4. To promote the development of that little nationality.

The book is printed in English at Copenhagen by Martius Truelsen, and the Prefatory Note bears date December, 1903.

Additions and corrections, changes of address, and other information will be gratefully received, if addressed to

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